

THIRTIETH ANNUAL REPORT
OF THE
ONTARIO DEPARTMENT OF MINES
1921

PARTS I AND II

DEPARTMENT OF MINING ENGINEERING

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PROVINCE OF ONTARIO
DEPARTMENT OF MINES

HON. H. MILLS, MINISTER OF MINES

THOS. W. GIBSON, DEPUTY MINISTER

THIRTIETH ANNUAL REPORT
OF THE
ONTARIO DEPARTMENT OF MINES

BEING

VOL. XXX, PART 1, 1921

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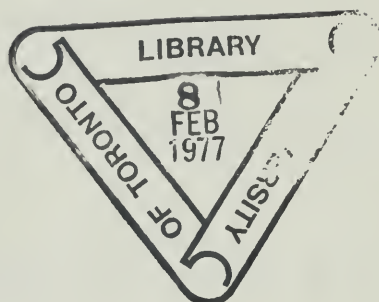
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LETTER OF TRANSMISSION

TO HIS HONOUR, LIONEL HERBERT CLARKE,

Lieutenant-Governor of the Province of Ontario.

SIR,—I have the honour to transmit to you herewith, for presentation to the Legislative Assembly of the Province of Ontario, the Thirtieth Annual Report of the Department of Mines.

I have the honour to be, Sir,

Your obedient servant,

HENRY MILLS,

Minister of Mines.

Department of Mines,
Toronto, 1921.

INTRODUCTORY LETTER

TO THE HONOURABLE H. MILLS,
Minister of Mines.

SIR,—I beg to lay before you herewith, the Thirtieth Report of the Department of Mines, being for the year 1920. The Report is published in seven parts, not only for convenience in handling and reference, but also for the sake of economy in printing. By this method the Department is enabled, when desirable, to publish a monograph dealing with a single field or a single subject without waiting for other matter, and also to vary the size of the edition according to the interest of the material and the probable demand for the report. Papers by different authors on adjacent areas or on like topics can also with advantage be grouped. The contents of the Thirtieth Report and the arrangement of the Parts numbering from one to seven, with the names of authors, are shown on the following page.

From time to time, as important discoveries are made and fresh mineral belts opened up, public interest naturally shifts from one metal or mineral to another. Thirty years ago, when the great resources of nickel and copper in the Sudbury area were beginning to be recognized and exploited, the demand was for information regarding the geology of the nickel-copper ranges and the relationships which the ore deposits bore to the enclosing rocks.

A little later, when gold was found widely scattered on the shores of Lake of the Woods, Seine river and Manitou lake, and when hopes were entertained, not yet realized, of establishing there important centres of gold production, the public looked to the Department for similar information regarding the gold occurrences of these areas.

So, likewise, when the phenomenal riches of the Cobalt silver field were revealed; and subsequently, when Porcupine began to assert its wonderful wealth of gold. To Porcupine has succeeded Kirkland Lake, whose rank as a gold producer next to Porcupine is now assured. Kirkland Lake is being followed by numerous other localities where gold in apparently important quantity has been found.

It now seems certain that the silver age of Ontario, in which Cobalt and its subsidiary camps caught and held the attention of the world, is to be followed by an age of gold, and that Northern Ontario will make really substantial contributions to the world's production of that metal. Naturally, the Department must put itself in a position to meet, as far as possible, the demand for information which such a programme of development inspires. Its permanent staff of geologists and other skilled men from the universities and elsewhere, year by year are sent to spend the open season in the wilds, and the results of their observations are printed in the reports and maps issued by the Department, which are distributed without charge. Not only is attention given to known mineral belts or areas, but the Department strives as much as possible to examine and depict the geology of previously unprospected and unmapped areas, whose situation and relationships are such as to encourage hope of their containing mineral wealth.

Ample evidence is afforded that these efforts of the Department are fully appreciated, both by investors and prospectors, and that the data thus obtained are used with good results by the latter in their labours. It is conceived that the function of the Department is not to attempt the discovery of actual deposits of minerals, but to facilitate their discovery by studying the conditions under which they exist, and the rocks or contacts most favourable for their occurrence, and by making the results available in easily understood form.

I regret that considerable delay has taken place in bringing out the full Report, especially Parts 1 and 7. This has been very largely due to the unfortunate printers' strike which began June 1st, 1921, and which prevented a single galley of proof being delivered at the Department for six months. Printing was then resumed, but on a reduced scale, and the work was attended with many difficulties. Indeed, the strike is still nominally in force, but it is expected that the Department's report for 1921 will soon begin to be placed, part by part, in your hands.

I have the honour to be, Sir,

Your obedient servant,

THOS. W. GIBSON,

Deputy Minister of Mines.

DEPARTMENT OF MINES,

Toronto, 1921.

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STATISTICAL REVIEW

OF

ONTARIO'S MINERAL INDUSTRY IN 1920

By W. R. Rogers

Economic transition conditions from a war to a peace basis that characterized the year 1919 continued through 1920, with the result that the mineral industry of Ontario remained more or less unsettled. An endeavour to maintain the high scale of prices and wages in most lines which had increased by gradual steps during the war period was in opposition to existing world conditions and a natural tendency to return to pre-war levels. The adverse exchange situation experienced by former belligerent countries in Europe permitted them to market their goods at much lower prices than was possible on the American continent, United States and Canadian commodity prices being thus forced down. This movement was not felt until the latter part of the year. If the process is gradual, heavy loss and bankruptcy will be avoided.

The deflation period in Canada, an expected war aftermath following the signing of the armistice, took nearly two years to arrive. Artificial methods of maintaining high prices finally proved ineffectual and lower levels prevailed, more particularly during the two closing months of the year. However, it is not the purpose of this review to analyze changes in economic conditions except in so far as they have a bearing on Ontario's mineral industry.

Just as labour was becoming more plentiful in the fall of the year the operation of gold and silver mines in Northern Ontario was handicapped by a shortage of hydro-electric power, precluding the possibility of utilizing the increase in man power. This power shortage, due to scanty precipitation during the late summer and fall, continued until the spring of 1921. At Porcupine the Hollinger gold mine rushed in several train loads of coal for use in its auxiliary steam plant. At Kirkland Lake the new 150-ton mill of the Wright-Hargreaves gold mine was ready for operation but could not start up for lack of power until spring. In the Cobalt camp the power shortage was acute for some weeks and this condition accentuated the difficulty of profitable operation resulting from a sharp decline in the price of silver.

Speaking generally the year was marked by high prices, which stimulated production despite high operating costs. Quantity production, therefore, as compared with previous years provides a more accurate criterion of the state of the mining industry than a basis of valuation. Details regarding output and conditions in the several phases of the mining industry are noted under separate headings. The value of metalliferous production exceeded that of any pre-war year, while the non-metallic valuation was the greatest in Ontario's history.

Table I, which follows, gives a summary of Ontario's mineral production in 1920, together with the number of employees and wages paid to workmen by operators.

TABLE I.—SUMMARY OF MINERAL STATISTICS OF ONTARIO FOR 1920

Product	Quantity	Value	Employees	Wages
		\$		\$
METALLIC.				
Gold..... ounces	565,283	11,686,043	1,986	3,113,084
Silver..... " 11,065,415		10,873,496	1,951	2,659,201
Copper in matte (a)..... short tons	11,715	2,928,750	3,258	5,555,469
Nickel in matte (a)..... " 21,371		10,685,500		
Iron ore (b)..... " 68,616		60,958	391	563,782
Iron, pig (c)..... " 76,164		2,204,205	761	1,351,601
Lead, pig..... lbs. 2,232,253		179,714	110	136,474
Copper..... " 6,825,772		1,041,994	(d) 749	1,149,414
Nickel, metallic..... " 11,015,692		3,852,141		
Nickel oxide..... " 4,890,571		1,151,490	(e) 516	619,632
Platinum metals..... ounces 10,036		1,996,535		
Cobalt, metallic..... lbs. 167,750		392,926		
Cobalt oxide..... " 569,182		1,210,810		
Other Cobalt and Nickel compounds..... " 161,442		16,991		
Total metallic.....		48,281,553	9,722	15,148,657
NON-METALLIC.				
Actinolite..... tons 100		1,160	9	939
Arsenic, crude and white..... lbs. 3,781,389		432,434	(c)	(c)
Clay products—(\$4,735,154).				
Brick, common..... M 123,551		2,209,265	1,793	1,772,494
Brick, fancy and pressed..... " 32,559		809,126		
Tile, drain..... " 9,784		359,373	46	55,256
Tile, building and roofing..... tons 58,737		369,530		
Pottery.....		127,049	264	320,880
Sewer pipe.....		860,811	859	1,283,359
Cement, Portland..... bbls. 2,035,594		4,377,814	19	32,000
Corundum..... tons 196		27,000	250	167,165
Feldspar..... " 37,335		268,295	57	59,986
Fluorspar..... " 3,704		67,381	97	70,552
Graphite, crude and refined..... " 1,956		132,882	178	220,795
Gypsum, crushed, ground and calcined..... " 74,707		404,162	292	350,376
Iron pyrites..... " 148,651		618,283	448	568,513
Lime..... bush. 4,982,912		1,799,763	42	36,741
Mica..... tons 719		54,169	20	10,643
Mineral water..... Imp. gals. 127,150		15,059	683	625,215
Natural gas..... M. cu. ft. 10,545,000		3,163,500	28	14,622
Peat..... tons 3,900		15,600	(f) 1,736	2,695,507
Petroleum, crude..... bbls. 181,750		724,145	82	82,549
Quartz and silica brick..... tons 94,650		366,441	338	442,004
Salt..... " 206,612		1,544,867	620	506,156
Sand and gravel..... cu. yds. 2,162,241		1,390,704	146	154,402
Sand-lime brick..... M 27,703		407,766	961	1,037,832
Stone, building, trap, granite, etc.....		3,944,972	60	77,818
Tale, crude and ground..... tons 20,359		306,319		
Total non-metallic.....		24,797,969	9,028	10,615,847
Add metallic.....		48,281,553	9,722	15,148,605
Grand total.....		73,079,522	18,750	25,764,461

(a) Copper and nickel in the matte valued at 10 and 20 cents per pound respectively.

(b) Exports and shipments to points other than Ontario blast furnaces. Total shipments of iron ore, 126,710 tons valued at \$510,000.

(c) Production from Ontario ore only. Total output of blast furnaces, 748,173 tons of pig iron, worth \$21,652,308.

(d) Employees and wages for nickel-copper refining operations.

(e) Employees and wages for silver-cobalt refineries.

(f) Employees and wages for petroleum refineries.

The value of metals produced in 1920 was greater than for any pre-war year, while the non-metallic valuation was the largest in Ontario's history. The following comparative statement shows the course of the mining industry during the five-year period, 1916 to 1920 inclusive, as indicated by the value of the total production:

TABLE II.—VALUE OF MINERAL PRODUCTION, 1916 TO 1920.

Product.	1916	1917	1918	1919	1920
METALLIC:	\$	\$	\$	\$	\$
Gold.....	10,339,259	8,698,735	8,502,480	10,451,709	11,686,043
Silver.....	12,703,591	16,183,208	17,415,882	12,904,312	10,873,496
Platinum metals.....				200,000	1,996,535
Cobalt (<i>a</i>).....	762,327	1,122,779	1,615,130	868,107	1,603,736
Copper.....	8,365,255	7,961,662	8,532,790	3,709,687	3,970,744
Nickel (<i>b</i>).....	20,685,564	21,041,956	27,840,422	11,925,229	15,689,131
Other Nickel and Cobalt compounds.....	60,956	42,026	73,347	188,083	16,959
Iron Ore (<i>c</i>).....	342,700	483,699	624,364	48,341	60,981
Pig iron (<i>d</i>).....	1,646,010	1,016,699	1,364,736	1,200,793	2,204,205
Lead (pig).....	70,863	172,601	149,841	94,507	179,714
Molybdenite.....	26,393	108,501	59,067		
Metallic production.....	55,002,918	56,831,857	66,178,059	41,590,759	48,281,553
NON-METALLIC:					
Actinolite.....		1,320	2,508	1,176	1,160
Arsenic.....	200,103	608,483	566,332	485,360	432,434
Asbestos.....	100	2,150			
Barite.....			900		
Brick, common and sand-lime.....	509,559	800,983	756,962	2,334,526	2,617,031
Brick, fancy, and pressed.....	318,942	474,614	396,698	539,908	809,126
Cement, Portland.....	2,242,433	2,934,271	1,910,839	3,659,720	4,377,814
Corundum.....	8,763	31,213	26,120		27,000
Feldspar.....	42,159	81,802	111,173	88,663	268,295
Fluorspar.....	10,146	66,474	153,190	60,389	67,381
Graphite.....	249,586	296,587	208,848	99,841	132,882
Gypsum.....	116,206	130,138	151,564	278,111	494,162
Iron pyrites.....	471,807	1,111,264	1,144,737	366,422	618,283
Lime.....	265,356	657,364	872,177	1,268,290	1,799,763
Mica.....	55,407	92,453	49,575	56,199	54,169
Mineral water.....	(<i>e</i>)	(<i>e</i>)	133,808	19,290	15,059
Natural gas.....	2,404,499	3,220,123	2,498,769	2,583,324	3,163,500
Peat fuel.....				1,750	15,600
Petroleum (crude).....	387,846	475,000	781,097	632,789	724,145
Phosphate of lime (apatite).....				31	
Pottery.....	87,025	94,501	88,275	119,551	127,049
Quartz (silica).....	223,514	358,674	452,711	179,070	366,441
Salt.....	700,515	1,047,707	1,287,039	1,395,368	1,544,867
Sand and gravel.....	470,963	431,597	553,638	501,666	1,390,704
Sewer pipe.....	216,749	378,923	362,536	679,100	869,811
Stone, building, crushed, etc.....	755,313	939,032	869,239	1,230,922	3,944,972
Tale, crude and ground.....	111,489	179,554	246,691	247,399	306,319
Tile, drain.....	275,471	546,040	309,899	354,700	359,373
Tile, building and roofing.....	176,953	301,688	195,588	186,592	369,530
Non-metallic production.....	10,300,904	15,261,975	14,170,913	17,293,157	24,797,969
Add metallic production.....	55,002,918	56,831,857	66,178,059	41,590,759	48,281,553
Total production.....	65,303,822	72,093,832	80,308,972	58,883,916	73,079,522

(*a*) Cobalt oxide and metallic cobalt.

(*b*) Nickel in matte, oxide and metallic nickel.

(*c*) Exports and shipments to points other than Ontario blast furnaces.

(*d*) Product from Ontario ore only.

(*e*) Production figures not collected.

In Table III is given the aggregate value of the metals and metallic products since the several substances began to be produced in Ontario down to the end of 1920. It should be pointed out that since 1911 the statistics of annual production credit pig iron only with the value of the pig iron product made from Ontario ore. This is but a small part of the total output, since the great bulk of the iron ore charged into the blast furnaces of the Province comes from the mines of Michigan and Minnesota. Conversely, part of the iron ore raised in Ontario is exported to the United States in the form of briquettes produced from low-grade magnetite ores. In the production tables credit is taken only for the ore exported or shipped to points other than Ontario blast furnaces, since to include the value of the ore converted into pig iron at home would involve a duplication of this item.

TABLE III.—VALUE OF TOTAL PRODUCTION OF METALS IN ONTARIO.

Metal or Product	Production to 31st December, 1919	Production, 1920	Production to 31st December, 1920
	\$	\$	\$
Gold	61,316,572	11,686,043	73,002,615
Silver	197,931,902	10,873,496	208,805,398
Platinum metals	1,500,000	1,996,535	3,496,535
Cobalt, including Cobalt oxide	6,787,006	1,603,736	8,390,742
Nickel, including Nickel oxide	149,935,762	15,689,131	165,624,893
Other Cobalt and Nickel compounds	418,828	16,991	435,819
Copper	53,656,767	3,970,744	57,627,511
Iron Ore	9,350,276	60,958	9,411,234
Pig Iron	80,126,710	2,204,205	82,330,915
Lead	605,102	179,714	784,816
Zinc Ore	92,410	.....	92,410
Molybdenite	209,735	.....	209,735
Total	561,931,070	48,281,553	610,212,623

Gold

For some years prior to 1903 the value of Ontario's output of gold exceeded that of silver. This position was reversed in 1904 when the silver mines of Cobalt began production. The pendulum has swung back again, and the gold production for 1920 exceeds that of silver. Despite labour scarcity and high operating costs for the first nine months of the year, followed by shortage of hydro-electric power during the last quarter, the yield of Ontario's gold mines was the largest in the history of the Province. The climb upward began with the discovery of Porcupine in 1909. Porcupine and Kirkland Lake are now recognized as important gold camps which have yet to reach their zenith of production.

Canada in the year 1920, owing to Ontario's contribution, was the only important gold-producing country in the world to show an increase in output over 1919. The decline in the world's gold production has been continuous since 1915, the year of maximum output, when 168.7 million dollars were produced. The following table shows the output in millions of dollars of leading countries and states for the last pre-war year, 1915, 1919 and 1920.

OUTPUT OF LEADING GOLD-PRODUCING COUNTRIES‡
(Millions of Dollars)

Source	1913	1915	1919	1920
world	459.9	468.7	365.2	334.9
Transvaal	182.0	188.0	172.2	168.6
United States	88.9	101.0	60.3	51.2
Australasia	51.8	49.0	26.1	23.3
Canada	16.6	19.0	15.8	15.9
Mexico	19.3	6.6	15.7	15.3
California	20.4	21.4	17.4	11.8
West Australia	27.1	25.0	15.2	12.8
ONTARIO	4.6	8.5	10.5	11.7
Rhodesia	14.1	18.9	12.3	11.4
India	11.2	11.5	10.5	9.0
Russia and Siberia . . . . .	....	26.3	11.0	1.4

‡ Figures abstracted from annual reports by the Director of the U.S. Mint.

The list of producing gold mines in Ontario was as follows:—

PRODUCING GOLD MINES, 1920

Name of Company.	Name of Mine.	Locality.	P.O. Address of Manager, etc.
Argonaut Gold, Limited.	Argonaut.	Gauthier tp.	Dane.
Contact Bay Mines, Ltd.	Contact Bay.	Van Horne tp.	Dryden.
Davidson Consolidated Gold Mines, Limited.	Davidson.	Porcupine.	South Porcupine.
Dome Lake Mining and Milling Company, Limited.	Dome Lake.	Porcupine.	South Porcupine.
Dome Mines Company, Limited.	Dome and Dome Extension.	Porcupine.	South Porcupine.
Hollinger Consolidated Gold Mines, Limited.	Hollinger.	Porcupine.	Timmins.
Jackson, W. S.		Schreiber.	Fort William.
Kirkland Lake Gold Mining Company, Limited.	Kirkland Lake.	Kirkland Lake.	Kirkland Lake.
Lake Shore Mines, Limited.	Lake Shore.	Kirkland Lake.	Kirkland Lake.
McIntyre-Porcupine Mines, Limited.	McIntyre.	Porcupine.	Schumacher.
*Northerown Porcupine Mines, Ltd.	Northerown.	Porcupine.	Timmins.
Porcupine Crown Mines, Ltd.	Porcupine Crown.	Porcupine.	Timmins.
Stone, W. E.	A.L. 113.	Mine Centre.	Mine Centre.
Teek-Hughes Gold Mines, Limited.	Teek-Hughes.	Kirkland Lake.	Kirkland Lake.

*Operated under the new name "Northerown Porcupine Mines, Ltd.," after May 15th, 1920, when the Porcupine Crown and Thompson-Krist mines were amalgamated.

Details of production are given in Table IV which follows:—

TABLE IV.—ONTARIO'S GOLD PRODUCTION, 1920.

Mine or Source	Ore milled tons	Gold Production		Silver Production		Total Value, gold and silver	Extraction per ton milled
		Fine ounces	Value	Fine ounces	Value		
PORCUPINE:							
Davidson Consolidated	3,003	478,482	\$ 11,210 29	35.40	\$ 35 76	\$ 11,246 05	3 70
Donne Lake	4,707	2,264,370	46,809 11	334.18	360 66	47,169 77	10 02
Dome	295,220	97,022,887	2,003,640 87	14,779.55	14,927 53	2,020,568 40	6 84
Hollinger Consolidated	630,205	298,222,783	6,164,264 92	55,802.77	55,399 88	6,219,664 80	9 56
Melnyre Porcupine	191,032	106,526,790	2,202,100 50	21,706.04	20,981 94	2,222,082 44	11 61
Northern Porcupine	11,678	4,675,579	96,584 37	801.01	716 72	168,830 31	9 43
Porcupine Crown	6,220	3,434,346	70,962 46	513.62	566 76		
Total Porcupine	1,162,065	512,625,237	10,597,572 52	93,972.57	92,989 25	10,689,561 77	9 20
KIRKLAND LAKE:							
Kirkland Lake	40,812	13,795,130	285,170 67	1,852.93	1,730 20	286,900 87	7 03
Lake Shore	19,779	24,291,888	502,113 34	1,722.99	1,621 62	503,734 96	25 47
Teck-Hughes	30,646	11,909,656	246,194 28	1,507.91	1,562 76	247,757 04	8 08
Total Kirkland Lake	91,237	49,996,674	1,033,478 29	5,083.83	4,914 58	1,038,392 87	11 38
MISCELLANEOUS:							
Argonaut (Gauthier tp.)	4,637	1,290,560	26,678 25	171.74	184 64	26,862 89	5 79
Contact Bay (Wabigoon Lake)	291	101,270	2,093 27	25.75	16 97	2,110 24	7 25
Jackson, W. S., (Schreiber)	1	3,000	62 01	1.05	74	62 75	
Stone, W. E., (Mine Centre)	2	5,181	107 10	1.55	1 28	108 38	
Nickel-Copper Refineries		1,260,600	26,052 00			26,052 00	
Total Miscellaneous	4,931	2,660,611	54,992 63	200.09	203 63	34,949 56	
Grand Total	1,258,233	565,282,520	11,686,043 44	99,256.49	98,107 46	11,762,904 20	

Gold-producing companies receive payment in New York funds irrespective of whether shipments are consigned to the Canadian or United States Mints. In consequence they reap the advantage of the exchange premium, which amounted to \$1,376,275 or 11.7 per cent in 1920.

In the following table the total gold output of the Province is given, also that from Porcupine and Kirkland Lake beginning in 1910 and 1913 respectively:—

TABLE V.—TOTAL GOLD PRODUCTION OF ONTARIO.

Year	Total Production \$	Porcupine		Kirkland Lake	
		\$	Per Cent.	\$	Per Cent.
1892-1909.....	2,509,492.....				
1910.....	68,498.....	35,539.....	51.8.....		
1911.....	42,637.....	15,437.....	36.2.....		
1912.....	2,114,086.....	1,730,628.....	81.8.....		
1913.....	4,558,518.....	4,294,113.....	94.1.....	65,260.....	1.2.....
1914.....	5,529,767.....	5,190,794.....	93.8.....	114,151.....	2.0.....
1915.....	8,501,391.....	7,536,275.....	88.6.....	551,069.....	6.5.....
1916.....	10,339,259.....	9,397,536.....	90.8.....	702,761.....	6.8.....
1917.....	8,698,735.....	8,229,744.....	94.5.....	404,346.....	4.6.....
1918.....	8,502,480.....	7,767,907.....	91.4.....	632,007.....	7.4.....
1919.....	10,451,709.....	9,941,804.....	95.1.....	486,809.....	4.7.....
1920.....	11,686,043.....	10,597,573.....	90.7.....	1,033,478.....	8.8.....
Total.....	73,002,615.....	64,737,350.....	88.7.....	3,989,884.....	5.5.....

Dividends.—The important period of gold mining in Ontario began with the opening of the Porcupine mines in 1910. Since that time the gold mines have paid out in returns to shareholders a total of \$17,551,541.65, details of which are given in Table VI.

TABLE VI.—DIVIDENDS AND BONUSES PAID BY GOLD MINING COMPANIES TO DECEMBER 31, 1920.

Name of Company	Date of Incorporation	Authorized Capital	Capital Stock Issued	Par value per share	Amount of Dividends and Bonuses paid to end of 1919	Amount of Dividends and Bonuses paid during 1920	Rate per cent.	Total of Dividends and Bonuses paid to Dec. 31st, 1920	Date when last Dividend or Bonus paid
Dome Mines Company, Ltd.	Mar. 23, 1910	\$ 5,000,000	\$ 4,763,670	10 00	\$ 1,500,000 00	\$ 416,886 00	10	\$ 1,916,886 00	Oct. 20, 1920
*Hollinger Consolidated Gold Mines, Ltd.	June 16, 1916	25,000,000	24,600,000	5 00	11,146,000 00	2,214,000 00	9	13,360,000 00	Dec. 31, 1920
Lake Shore Gold Mines, Ltd.	Feb. 25, 1914	2,000,000	2,000,000	1 00	200,000 00	80,000 00	4	280,000 00	Oct. 1, 1920
McIntyre-Porcupine Mines, Ltd.	Mar. 16, 1911	1,000,000	3,640,283	1 00	1,448,613 20	546,042 45	15	1,994,655 65	Sept. 1, 1920
Porcupine Crown Mines, Ltd.	May 26, 1913	2,000,000	2,000,000	1 00	840,000 00			840,000 00	July 15, 1917
†Rea Consolidated Gold Mines	April 5, 1911	1,000,000	200,000	5 00	12,000 00			12,000 00	1913
Tough-Oakes Gold Mines, Ltd.	July 15, 1913	3,000,000	2,657,500	5 00	398,625 00			398,625 00	Dec. 27, 1916
Total					13,350,200 90	3,256,928 45		17,551,541 65	

*Hollinger Consolidated Gold Mines, Limited, is a consolidation of the Acme Gold Mines, Limited, Millerton Gold Mines, Limited, and Hollinger Gold Mines, Limited. Dividends include \$160,000 paid by Acme prior to the amalgamation.

†The dividend paid was by the lessee, Mines, Leasing and Development Company, Limited.

Silver=Cobalt

On January 12th the price of silver was \$1.37 per ounce, the highest on record during the history of the Cobalt camp. The decline which followed was gradual until the lowest quotation for the year, 59 $\frac{1}{4}$ cents per ounce for foreign silver on the New York market, was reached on Dec. 10th. This fall in price accompanied by hydro-electric power shortage late in the year, due to scanty precipitation during the summer and fall, resulted in certain mines closing down or curtailing output.

Gowganda's silver production came from the Miller Lake O'Brien, Bonsall and Castle mines, the last mentioned being operated by the Trethewey Silver Cobalt Mining Company.

In addition to the silver content of the ores, concentrates, residues, etc., the producing mines in many cases are paid for the cobalt contained in them. Returns show that for 987,441 pounds of cobalt recovered and paid for, the producing companies received \$564,974 from consignees in southern Ontario, England and the United States, or an average of 57.8 cents per lb. The price realized was much higher than in former years.

Since the discovery of silver at Cobalt in 1903 shipments from the camp and outlying silver areas have been as follows:—

Year.	Average price, cents per ounce.	Ounces.	Value \$
1904	57.2	206,875	111,887
1905	60.4	2,451,356	1,360,503
1906	66.8	5,401,766	3,667,551
1907	67.5	10,023,311	6,155,391
1908	52.9	19,437,875	9,133,378
1909	51.5	25,897,825	12,461,576
1910	53.5	30,645,181	15,478,047
1911	53.3	31,507,791	15,953,847
1912	60.8	30,243,859	17,408,935
1913	57.8	29,681,975	16,553,981
1914	54.8	25,162,841	12,765,461
1915	49.69	24,746,534	12,135,816
1916	65.661	19,915,090	12,643,175
1917	81.417	19,401,893	16,121,013
1918	96.772	17,661,694	17,341,790
1919	111.122	11,214,317	12,738,994
1920	100.900	10,846,321	10,654,471
Total to end of 1920		314,446,506	192,685,816

Mines shipping over a quarter million ounces of silver in 1920 are given in order:

Mine.	Ounces.
Nipissing	3,390,537
Mining Corporation of Canada	1,806,274
O'Brien	1,179,706
Coniagas	990,176
McKinley-Darragh-Savage	613,428
Kerr Lake	610,604
La Rose	492,801
Miller Lake O'Brien	376,417
Temiskaming	298,627

Classified according to source, the output of silver in 1920 was derived as follows:—

	Ounces.
Cobalt	10,402,250
South Lorrain	8,252
Gowganda	433,352
Cane township, Maple Mountain and Silver Islet	2,467
Recovered from gold ores	99,255
Recovered from nickel-copper refining	119,839
Total	11,065,415

The producers of silver are given in the following list:—

SILVER PRODUCERS IN 1920.

Operator.	Mine or Source.	Location.
Aladdin Cobalt Company, Limited.....	Chambers-Ferland.....	Cobalt.
Angus, D. H.....	Cobalt Silver Queen (lease)	Cobalt.
Bailey Silver Mines, Limited.....	Bailey.....	Cobalt.
Beaver Consolidated Mines, Limited.....	Beaver.....	Cobalt.
Bonsall Mines, Limited.....	Bonsall.....	Gowganda.
Brewer and Brewer.....	Cobalt Silver Queen (lease)	Cobalt.
Cane Silver Mines, Limited.....	Cane.....	Cane tp.
Central Operating Company.....	Foster (lease).....	Cobalt.
Cobalt Provincial Mining Co., Limited.....	Provincial.....	Cobalt.
Colonial Mining Company, Limited.....	Colonial.....	Cobalt.
Coniagas Mines, Limited.....	Coniagas and Trethewey.....	Cobalt.
Crown Reserve Mining Company, Ltd.....	Crown Reserve.....	Cobalt.
Devlin and Enright.....	Devlin.....	James tp.
Edwards & Wright, Ltd.....	Green-Meehan.....	North Cobalt.
Hargrave Consolidated Mines, Limited.....	Hargrave.....	Cobalt.
Hudson Bay Mines, Limited.....	Hudson Bay.....	Cobalt.
Islet Exploration Co., Ltd.....	Silver Islet.....	Thunder Bay Dist..
Keeley Silver Mines, Limited.....	Keeley.....	South Lorrain.
Kerr Lake Mining Company, Limited.....	Kerr Lake.....	Cobalt.
Lansdowne, E. T.....	Silver-cobalt plant clean-up	Copper Cliff.
La Rose Mines, Limited.....	La Rose.....	Cobalt.
McDonald Syndicate.....	Ruby (lease).....	Cobalt.
McKinley-Darragh-Savage Mines of Co- balt, Limited.....	McKinley-Darragh-Savage	Cobalt.
Mining Corporation of Canada, Limited, The.....	Cobalt Lake, Townsite- City, Buffalo.....	Cobalt.
Nipissing Mining Company, Limited.....	Nipissing.....	Cobalt.
Northern Customs Concentrators, Ltd.....	Silver Cliff and Chambers- Ferland.....	Cobalt.
O'Brien, M. J., Limited.....	O'Brien.....	Cobalt.
	Miller Lake O'Brien.....	Gowganda.
Peterson Lake Silver Cobalt Mining Co., Limited.....	Peterson Lake.....	Cobalt.
Post, W. J.....	Silver Queen (lease).....	Cobalt.
Reeve-Dobie Mines, Limited.....	Reeve-Dobie.....	Gowganda.
Reliance Silver Mines, Ltd.....	Reliance.....	Cobalt.
Right of Way Mines, Limited.....	Right of Way.....	Cobalt.
Smith, J. G. and E. C.....	Kell.....	Gowganda.
Temiskaming Mining Company, Limited.....	Temiskaming.....	Cobalt.
Trethewey Silver-Cobalt Mine, Limited.....	Castle.....	Gowganda.
White Reserve Mining Co., Limited.....	White Reserve.....	Maple Mountain.

In Table VII are shown the shipments of ore, concentrates and bullion from the mines of Cobalt, Gowganda and outlying silver areas since mining began in 1904. By "shipment" is meant consignment to outside points whether in Canada or the United States, but not movements within the camp, as for example, ore hauled or shipped by rail from a mine to a concentrating or reduction plant in Cobalt itself. It will be noted that the quantity of ore shipped away from the camp has been reduced to relatively small proportions.

TABLE VII.—SHIPMENTS FROM SILVER MINES, 1904 TO 1920

Year.	No. of Producing Mines.	Ore			Concentrates and Residues.			Bullion.	Total.	
		Tons.	Silver, Ounces	Average per ton, Oz.	Tons.	Silver, Ounces	Average per ton, Oz.	Ounces	Ounces.	Value, \$
1904.	4	158	206,875	1,309	.....	.....	.....	.....	206,875	111,887
1905.	16	2,144	2,451,356	1,143	.....	.....	.....	.....	2,451,356	1,360,503
1906.	17	5,335	5,401,766	1,013	.....	.....	.....	.....	5,401,766	3,667,551
1907.	28	14,788	10,023,311	677	.....	.....	.....	.....	10,023,311	6,155,391
1908.	30	24,487	18,022,480	736	1,137	1,415,395	1,244	.....	19,437,875	9,133,378
1909.	31	27,729	22,436,355	809	2,948	3,461,470	1,714	.....	25,897,825	12,461,576
1910.	41	27,437	22,581,714	821	6,845	7,082,834	1,030	980,633	30,645,181	15,478,047
1911.	34	17,278	20,318,626	1,176	9,375	8,056,189	858	3,132,976	31,507,791	15,953,847
1912.	30	10,719	15,395,504	1,436	11,214	9,768,228	871	5,080,127	30,243,859	17,408,935
1913.	35	9,861	13,668,079	1,386	10,016	8,489,321	770	7,594,575	29,681,975	16,553,981
1914.	32	4,302	6,504,753	1,511	12,152	8,915,958	733	9,742,130	25,162,841	12,665,461
1915.	24	2,865	6,758,286	2,359	11,996	10,001,548	834	7,986,700	24,746,534	12,135,816
1916.	28	2,177	4,672,500	2,146	8,561	7,598,011	887	7,644,579	19,915,090	12,643,175
1917.	28	2,288	3,271,353	1,429	13,750	6,445,243	469	8,053,318	19,401,895	16,121,013
1918.	38	1,456	1,401,950	962	17,958	5,793,756	323	10,466,888	17,661,694	17,341,790
1919.	33	850	806,311	949	15,208	4,024,764	265	6,383,764	11,244,317	12,738,594
1920.	35	578	668,081	1,152	9,757	3,777,812	387	6,402,423	10,846,321	10,654,471
Total.	.....	154,452	154,586,430	1,001	131,887	84,849,977	643	73,398,113	314,446,504	192,685,816

Treatment and Reduction Plants.—Following is a synopsis of the operation of plants at Cobalt which treat custom or purchased ores by way of sampling, concentration or reduction to bullion. Employees engaged in these works numbered 338 and their wages amounted to \$536,455.

*ORE SAMPLING, CONCENTRATION AND REDUCTION WORKS, 1920.

Firm	Ore sampled	Ore and Tailings treated	Concentrates sampled	Concentrates produced	Concentrates treated	Base Bullion, etc., treated
	tons	tons	tons	tons	tons	lbs.
Cobalt Reduction Company.....	.....	11,593	.....	.....	392	3,462
Dominion Reduction Company.....	.....	43,006	.....	.....	.....	.....
Nipissing Mining Company, Ltd.....	.....	229	.....	.....	.....	8,637
Northern Customs Concentrators, Ltd.....	.....	14,622	.....	423	.....	.....
Temiskaming Testing Laboratories..	436	.....	940	.....	.....	.....
Total.....	436	69,450	423	940	392	12,099

*Treatment of Customs or Purchased Ore only.

TABLE VIII.—TOTAL SHIPMENTS FROM SILVER MINES, 1904 TO 1920.

Year.	Copper (a)		Lead (a)		Nickel (b)		Cobalt (c)		Arsenic		Silver		Total Value.
	Tons	Value	Tons	Value	Tons	Value	Tons	Value	Tons	Value	Ounces	Value	
1904		\$		\$	14	3,467	16	19,960		\$	206,875	111,887	\$
1905					75	10,000	118	100,000			2,451,356	1,360,503	
1906					160		321	80,704			5,401,706	3,667,551	
1907					370	1,174	739	104,426			10,023,311	6,155,391	
1908					612		1,224	111,118			19,437,875	9,133,378	
1909					766		1,533	94,065			25,897,181	12,461,576	
1910					504		1,098	54,699			30,645,825	15,478,047	
1911					392		852	170,890			31,507,791	15,953,847	
1912					429	14,220	934	314,381			30,243,859	17,408,935	
1913					377	13,326	821	420,386			29,681,975	16,553,981	
1914 (d)					90	28,978	351	590,406			25,162,841	12,765,461	
1915					35	28,353	206	383,261			24,746,534	12,135,816	
1916					79	59,380	400	805,014			19,915,090	12,643,175	
1917	53	28,840			155	125,071	337	1,138,190			608,483	16,121,013	
1918	72	35,712	3	453	186	156,893	380	1,640,310			17,661,694	19,741,490	
1919	110	40,976	12	1,296	276	188,418	298	1,019,479			11,214,317	12,738,994	
1920	50	17,494	5	792	127	93,233	283	1,605,365			10,846,321	10,654,471	
Total	285	123,022	20	2,541	4,647	722,513	9,911	8,653,554	4,605	3,007,788	314,446,504	192,658,816	205,195,234

(a) Copper and lead are recovered from certain silver ores and concentrates shipped to United States refineries. These metals are valued at the average prices for the year, namely: copper, 17.5 cents and lead 8.0 cents per pound in 1920.

(b) Metals and metallic contents of all Nickel compounds.

(c) Metals and metallic contents of all Cobalt compounds.

(d) Prior to 1914 an estimate based on assays was made of the nickel, cobalt and arsenic contained in the ores; subsequently actual recoveries have been reported.

Refineries.—The companies named hereunder with plants situated in southern Ontario, treat silver-cobalt ores, concentrates and residues:

REFINERS OF SILVER-COBALT ORES, 1920.

Name of Company	Location of Works	P.O. Address
Deloro Smelting and Refining Co., Limited	Deloro,	Deloro,
Coniagas Reduction Co., Limited,	Thorold,	St. Catharines.
Metals Chemical, Limited*,	Welland,	Welland
Ontario Smelters & Refiners, Ltd.	Welland,	Welland.

*Metals Chemical, Limited sold the Welland plant in March, and after April 1st it was operated by Ontario Smelters and Refiners, Limited. The last mentioned company remodelled the plant and reported a small production, chiefly of cobalt and nickel oxides from residues on hand.

The operations of the refining companies during 1920 are summarized in the figures given below. Apart from the silver recovered, from Cobalt and outlying silver areas, the marketed by-products had a value of \$2,135,330.

OPERATIONS OF SILVER-COBALT REFINERIES IN ONTARIO, 1920.

Schedule	Production	Marketed.	
	Quantity	Quantity	Value
			\$
Ore treated,	2,954		
Concentrates treated,	1,242		
Residues,	4,792		
Silver,	3,464,212	3,334,724	3,485,144
Arsenic, Crude and White,	3,999,801	3,765,611	431,527
Cobalt Oxide,	762,434	569,182	1,210,810
Cobalt Hydroxide, Sulphate, Acetate and Hydrate, ..	1,717	1,717	1,629
Cobalt, Metallic,	277,626	167,750	329,926
Nickel Oxide,	407,315	24,579	6,584
Nickel Silohate and Carbonate,	159,725	159,725	15,362
Nickel, Metallic,	110,235	204,537	71,287
Copper Sulphate,	221,920	104,105	5,205
Total value of Products Marketed,			5,620,474

The number of workmen employed in the refineries was 516 and the wages paid them amounted to \$619,632.

The following figures have been compiled from information furnished by refineries in the United States which treated products from Ontario silver mines:—

Ore treated, tons	42
Concentrates treated, tons	1,957
Residues or slag treated, tons	30
Silver recovered, ounces	705,508
Gold recovered, ounces	584
Copper recovered, lbs.	99,964
Lead recovered, lbs.	9,528
Nickel recovered, lbs.	6,906

Shipments were consigned to the following:—

- American Smelting and Refining Company, (Penblo Col., and Perth Amboy, N.J.).
- Pennsylvania Smelting Co., (Carnegie, Pa.).
- United States Metal Refining Co., (Chrome, N.J.)

TABLE IX.—DIVIDENDS AND BONUSES PAID BY SILVER MINING COMPANIES TO DECEMBER 31, 1920.

Name of Company	Date of Incorporation	Authorized Capital	Capital Stock Issued	Par value per share	Amount of Dividends and Bonuses paid to end of 1919	Amount of Dividends and Bonuses paid during 1920	Rate per cent	Total of Dividends and Bonuses paid to 31st Dec., 1920	Date when last Dividend or Bonus paid
		\$ c.	\$ c.	\$ c.	\$ c.	\$ c.		\$ c.	
Aladdin Cobalt Company, Limited	Aug. 23, 1912	500,000	500,000	5.00	75,000 00			75,000 00	Apl. 30, 1917
Beaver Consolidated Mines, Ltd.	Mar. 1, 1907	2,000,000	2,000,000	1 00	650,000 00	60,000 00	3	710,000 00	Apl. 8, 1916
Buffalo Mines, Ltd., The (a)	Apl. 27, 1906	500,000	500,000	50	2,787,000 00			2,787,000 00	May 28, 1914
Cassey Cobalt Silver Mining Co., Limited	Dec. 19, 1906	100,000	100,000	1.00	203,249 33			203,249 33	Apl. 22, 1914
Cobalt Central Mines Co., Ltd.	Dec. 13, 1905	5,000,000	5,000,000	1 00	192,845 00			192,845 00	Aug. 25, 1909
Cobalt Comet Mines, Ltd. (b)	Apl. 16, 1913	1,000,000	1,000,000	1 00	230,000 00			230,000 00	Apl. 1, 1915
Cobalt Silver Queen, Ltd.	Apl. 1, 1906	1,500,000	1,500,000	1 00	315,000 00			315,000 00	Dec. 31, 1908
Coniagas Mines, Limited, The	Nov. 24, 1906	4,000,000	4,000,000	5 00	9,640,000 00	1,100,000 00	7 1/2	10,740,000 00	Dec. 22, 1920
Crown Reserve Mining Co., Ltd.	Jan. 16, 1907	2,000,000	1,999,957	1 00	6,190,849 00			6,190,849 00	Dec. 28, 1916
Foster Cobalt Mining Co., Ltd.	Feb. 14, 1906	1,000,000	915,588	1 00	45,000 00			45,000 00	Jan. 1, 1907
Hudson Bay Mines, Ltd.	July 16, 1909	3,500,000	3,200,050	5 00	778,909 42			778,909 42	Aug. 31, 1913
Kerr Lake Mining Company, Ltd.	Aug. 9, 1905	40,000	40,000	100 00	8,785,000 00	80,000 00	200	8,865,000 00	Oct. 11, 1920
La Rose Mines, Ltd.	May 31, 1908	1,500,000	1,500,000	1 00	6,300,546 84			6,300,546 84	Apl. 20, 1918
McKinley-Darragh-Savage Mines of Cobalt, Ltd.	Apl. 27, 1906	2,500,000	2,247,692	1 00	5,685,668 88	269,723 04	12	5,955,391 86	Oct. 1, 1920
Mining Corporation of Canada, Ltd. (c)	Nov. 23, 1916	8,300,250	8,300,250	5 00	4,877,349 22	622,518 75	7 1/2	5,499,867 87	Sept. 15, 1920
City of Cobalt Mining Co., Ltd. (d)	Oct. 5, 1906	500,000	1,500,000	1 00	145,000 00			145,000 00	Apl. 15, 1920
Cobalt Lake Mining Co., Ltd. (d)	Jan. 7, 1909	1,500,000	3,000,000	1 00	465,000 00			465,000 00	May 29, 1914
	Dec. 22, 1906	3,000,000	3,000,000	1 00					

TABLE IX.—Continued.

Name of Company	Date of Incorporation	Authorized Capital	Capital Stock Issued	Par value per share	Amount of Dividends and Bonuses paid to end of		Amount of Dividends and Bonuses paid during	Rate per cent.	Total of Dividends and Bonuses paid to 31st Dec., or Bonus was paid	Date when last Dividend paid
					1918	1919	1919			
		\$	\$	\$ c.	\$	\$	\$	c.	\$	
Cobalt Townsite Mining Co., Ltd. (d)	May 8, 1906	100,000	45,011	1 00	1,042,259 61				1,042,259 61	Nov. 11, 1914
Nipissing Mining Co., Ltd. (e)	Dec. 16, 1904	250,000	250,000	100 00	21,283,297 25	1,835,000 00	734 23	118,297 25	Oct. 20, 1920	
Penn-Canadian Mines, Ltd. (f)	Apr. 24, 1912	1,500,000	1,349,705	1 00	175,461 65				175,461 65	Sept. 10, 1917
Peterson Lake Silver-Cobalt Mining Co., Ltd.	Apr. 11, 1906	3,000,000	2,469,802	1 00	462,350 35				462,350 35	Jan. 2, 1917
Right of Way Mining Co., Ltd.	July 13, 1906	500,000	499,518	1 00	324,643 93				324,643 93	Oct. 1, 1909
Right of Way Mines, Ltd.	Sept. 11, 1909	2,000,000	1,685,500	1 00	252,825 00				252,825 00	Mar. 17, 1917
Senece-Superior Silver Mines, Ltd.	Sept. 29, 1911	500,000	478,884	1 00	1,579,817 20				1,579,817 20	Dec. 15, 1916
Teniskaming Mining Co., Ltd.	Nov. 5, 1906	2,500,000	2,500,000	1 00	2,059,156 25	100,000 00	4	2,159,156 25	Jan. 31, 1920	
Teniskaming and Hudson Bay Mining Co., Ltd.	July 10, 1903	25,000	7,761	1 00	1,940,250 00				1,940,250 00	Nov. 10, 1914
Trethewey Silver Cobalt Mines, Ltd.	May 30, 1906 June 1, 1911	2,000,000	1,000,000	1 00	1,211,998 50				1,211,998 50	Jan. 2, 1919
Wetlaufer Lorrain Silver Mines, Ltd.	Nov. 30, 1908	1,500,000	1,416,590	1 00	637,465 50				637,465 50	Sept. 22, 1913
Total					78,335,942 87	4,067,241 79			82,403,184 66	

(a) In 1917 the capital stock of the company was reduced from \$1000,000 to \$750,000, in 1918 from \$750,000 to \$500,000, and on December, 21 1919, from \$500,000 to \$150,000, by returning to shareholders amounts equal to the reduction in capital, leaving 300,000 shares issued of 50 cents each.

(b) Cash assets amounting to \$50,000 paid on April 27, 1917.

(c) Mining Corporation of Canada, Limited, owns and operates the City of Cobalt, Cobalt Lake and Cobalt Townsite mines.

(d) Now owned and operated by Mining Corporation of Canada, Limited.

(e) Includes \$16,288,297 25 paid in dividends by the Nipissing Mines Co. (the holding company) to the end of 1916.

(f) Paid out of capital \$40,491.15 on Sept. 10, 1917, and an equal amount on April 24, 1918.

Nickel, Copper, and the Platinum Metals

The year 1920 marked the beginning of smelting and refining operations by the British America Nickel Corporation. The ore comes from the old Murray mine, which was found by diamond drilling to contain large reserves. In January the new smelter at Nickelton was put in blast. The resulting Bessemer nickel-copper matte, which is produced without preliminary roasting of the ore, is shipped to the electrolytic refinery at Deschênes on the Quebec side of the Ottawa river, near Hull. The new refinery, in which the Hybinette electrical process is employed, began operations during the second quarter of the year. Electrolytic nickel and copper are being produced, but no slimes have been treated for the recovery of gold, silver and metals of the platinum group.

The production of ore during the year from the several mines was as follows:—

British America Nickel Corporation:—		Tons
Murray.....		277,484
International Nickel Company of Canada:—		
Creighton.....		789,056
Mond Nickel Company:—		
Levack.....	31,820	
Garson.....	35,541	
Worthington.....	20,375	
Bruce.....	25,639	
Victoria No. 1.....	20,915	
		134,290
Total.....		1,200,830

In Table X given below is indicated the course of the nickel industry during the last five years. That this metal takes on added importance during times of war is sufficiently shown by the fact that while in 1914 the quantity of ore smelted was 947,053 tons, it rose in 1918 to 1,559,892 tons, and fell to 754,567 tons in 1919.

For the purpose of this table the nickel and copper in matte produced in 1920 were valued at 25 cents and 12½ cents per pound, respectively.

TABLE X.—NICKEL-COPPER MINING AND SMELTING, 1916-1920.

Schedule	1915	1916	1917	1919	1920
Ore raised..... tons.	1,572,804	1,536,828	1,643,040	614,955	1,200,830
Ore smelted..... "	1,546,215	1,453,661	1,559,892	754,567	1,087,531
Bessemer matte produced..... "	80,010	78,897	87,184	42,735	57,938
Nickel contents of matte..... "	41,299	41,887	45,886	22,035	30,615
Copper contents of matte..... "	22,430	21,197	23,843	12,099	16,021
Value of Nickel in matte..... \$	20,649,279	20,943,500	27,531,600	11,017,500	15,307,350
Value of Copper in matte..... \$	8,299,051	6,842,890	8,453,880	3,387,720	4,005,300
Wages paid..... \$	4,920,720	5,570,587	7,861,773	3,382,151	5,555,469
Men employed..... No.	4,730	3,356	3,145	2,536	3,258

The following figures summarize the operations of the International Nickel Company of Canada's refinery at Port Colborne and that of the British America Nickel Corporation at Deschênes:—

TABLE XI.—NICKEL-COPPER REFINING, 1920.

Schedule		Quantity	Value
		\$	\$
Matte treated.....	tons	17,297	
Nickel Oxide marketed.....	lbs.	1,866,001	1,141,996
Metallic Nickel recovered.....	"	10,811,155	3,780,854
Blister Copper and Electrolytic Copper recovered.....	"	6,695,596	1,019,258
Gold.....	ounces	290.26	7,805
Silver recovered.....	"	37,957	33,884
Platinum metals.....	"	282.04	18,009
Total value of Products.....			6,002,716
Employees.....	No.	749	
Wages paid.....	\$		1,149,414

Returns by United States refineries from Ontario gold and silver ores treated show a recovery of 100,176 pounds of copper and 6,906 pounds of nickel. The average New York price of electrolytic copper was 17.456 cents per pound for the full year, as compared with 18.691 cents in 1919. During the last quarter of the year, the market for nickel and copper was dull, prices dropped and stocks accumulated. In consequence, the International Nickel Company of Canada curtailed its output by 25 per cent. on November 1st, thereby reducing production to 3,000 tons of nickel-copper matte and 400 tons of refined nickel per month. A further reduction in output has since been made by this company. The mine and smelter of the British America Nickel Corporation closed down on February 26th, 1921. Similar action will follow at the refinery as soon as matte shipped from the smelter has been treated. Vice-President W. A. Carlyle states that this action became necessary owing to bad market conditions for the products, nickel and copper.

Platinum Metals.—Nickel-copper ores from Sudbury carry appreciable quantities of gold, silver, platinum, palladium and other metals of the platinum group. Recoveries made from the Mond Nickel Company's mattes have been published in a recent bulletin on Platinum, issued by the Imperial Institute of London. The figures follow: Platinum, 3,722 ounces in 1916, 4,749 ounces in 1917 and 4,958 ounces in 1918. In 1915 the Mond mattes were estimated to contain 3,078 ounces of platinum, 5,474 ounces of palladium and 973 ounces of iridium and rhodium. In 1919 from mattes treated by the International Company at Port Colborne, Ont., and Bayonne N.J., there was a recovery of 1,770 ounces of platinum-group metals, of which 642 ounces were platinum. These figures place Ontario in third place among the platinum producing countries of the world, Russia and Colombia alone having a greater production.

Recoveries of platinum metals in 1920 as reported to the Ontario Department of Mines by the Mond Nickel Company in Great Britain and the International Nickel Company in the United States were as follows: platinum, 8,345 ounces; palladium 10,199 ounces; and rhodium group metals, 522 ounces. The average price of platinum for the year was \$110.90 per fine ounce. Matte treated in the New Jersey refinery was 30,740 tons, but it must be borne in mind that the precious metals recovered do not bear a definite ratio to the matte treated for the reason that residues are allowed to accumulate over irregular periods and recoveries cannot be credited to the matte treated in any particular year.

Iron Ore

The quantity of the iron ore raised in 1920 was 187,867 tons. Roasted and nodulized siderite shipments from the Magpie mine of the Algoma Steel Corporation, and beneficiated magnetite in the form of briquettes by Moose Mountain, Limited, totalled 126,710 short tons, valued at \$510,000. During the year 6,816 tons of briquettes worth \$60,958 were shipped to points other than Ontario blast furnaces. Nearly ninety per cent. of the ore smelted was of foreign origin.

Following is a list of iron mines from which shipments were made during the year:—

SHIPPERS OF IRON ORE, 1920.

Company or Firm.	Mine.	Location.	Kind of Ore.	P.O. Address of Company.
Algoma Steel Corporation, Ltd.	Magpie.	Algoma dist.	Siderite.	Sault Ste. Marie.
Moose Mountain, Ltd.	Moose Mountain	Hutton tp. (Sudbury dist.)	Magnetite.	Sellwood.

In the United States 67,604,465 gross tons were mined in 1920. Shipments were 69,281,341 gross tons, according to U.S. Geological Survey figures, the average value of the iron ore at the mines being \$1.11 per ton, as compared with \$3.61 in 1919. Only during three war years, 1916-17-18, has this output been exceeded. It is interesting to note that 86 per cent. of the ore or 60 million tons came from the Lake Superior region. Of the "Lake" shipments 67 per cent. was of Minnesota origin and 31 per cent. from Michigan. The prices per ton of "Lake" ores were the highest on record, namely, \$6.70 to \$7.45 per gross ton depending on grade and metallic iron content which ranged from 51.5 to 55 per cent.

Pig Iron, Steel, Ferro-Alloys and Coke

Of the 1,493,837 tons of iron ore smelted in Ontario in 1920, there were 1,341,661 tons imported from the United States. Ontario ore smelted was 152,176 tons, or 10.18 per cent. of the total. Pig iron credited to Ontario in Tables I and II represents only that proportion of the total output equivalent to the percentage of domestic ore used. In addition to ore, furnaces were charged with limestone worth \$535,029 and coke valued at \$9,549,290.

Furnaces operated at Sault Ste. Marie, Hamilton, Port Colborne, and Midland. The stack at Parry Sound belonging to the Parry Sound Iron Company, Limited, has not been in blast since October 1st, 1919, and that of the Standard Iron Company, Limited, at Deseronto since June of 1919. The Midland stack was blown in on October 20th, 1920, after being idle since August, 1919. The Canadian Steel Corporation, Limited at Ojibway, a suburb of Windsor on the Detroit river, has two blast furnaces under construction, the capacity of each being 550 tons daily. To the end of 1920 about \$4,000,000 had been expended on plant construction.

Both the Sault Ste. Marie and Hamilton plants produce open-hearth steel. In 1907 in the United States about 11,600,000 gross tons each of Bessemer and open-hearth steel were produced. In 1919 the ratio of open-hearth to Bessemer was nearly 4 to 1. The pig iron required for Bessemer steel is roughly 110 per cent. of the steel product, while in open-hearth furnaces pig iron represents 40 to 80 per cent. of the steel product, the manufacturer using "scrap" supply to supplement the pig.

IRON BLAST FURNACES IN OPERATION, 1920.

Name of Company.	Furnaces		Fuel used.	Location.
	Number.	Aver. days operated		
Algoma Steel Corporation, Limited...	4	318	Coke.....	Sault Ste. Marie.
Canadian Furnace Company, Limited.	1	318	Coke.....	Port Colborne.
Midland Iron and Steel Co., Ltd.	1	72	Coke.....	Midland.
Steel Company of Canada, Limited...	2	250	Coke.....	Hamilton.

The following table gives particulars of the iron and steel-making industry of the Province for the last five years:—

IRON AND STEEL STATISTICS, 1916-1920.

Schedule.	1916	1917	1918	1919	1920
Ontario ore smelted.....short tons	215,366	94,318	99,852	97,514	152,176
Foreign ore smelted....."	1,056,810	1,221,881	1,400,085	1,201,834	1,341,661
Limestone for flux....."	296,988	319,535	405,683	343,907	349,960
Coke....."	708,273	723,657	869,729	736,872	818,698
Charcoal.....bush.	1,843,209	1,288,390		177,795	
Pig iron produced.....short tons	699,202	691,233	751,650	623,586	748,173
Value of pig iron produced.....\$	9,739,701	14,201,695	20,522,356	16,010,537	21,652,308
Steel made.....short tons	686,959	862,504	881,509	616,251	707,692
Value of Steel made.....\$	12,847,309	22,179,982	28,792,361	17,913,263	26,366,524

Ferro-Alloys.—Production in 1920 included 5,496 tons of speigeleisen worth \$260,020 by the Algoma Steel Corporation, the bulk of the raw material used being manganiferous iron ore from Minnesota. In addition, a total of 21,171 tons of ferro-silicon worth \$1,092,420 were turned out by Electro-Metals, Limited, of Welland; and also to a lesser extent by manufacturers of artificial abrasives from imported bauxite, namely, the Canadian Corundum and National Abrasive companies of Niagara Falls, and the Norton Company at Chippawa.

The Welland plant used 13,367 gross tons of quartzite from its Killarney quarry, 1,159 tons of pyrites ore cinder from the United States and 11,507 tons of steel turnings which came from both United States and Canadian points. This company produced ferro-silicon which has 15, 25 and 50 per cent. non-ferrous content, the bulk of the output being the 15 and 50 per cent. grades.

Coke.—In North America coke has been made for 80 years in beehive ovens and for one-third of that time in by-product ovens. In 1919 the yield of the latter equalled that of the former for the first time. Two great advantages of by-product ovens were emphasised by George Otis Smith, Director of the U.S. Geological Survey, in an address before the American Iron and Steel Institute: (1) The yield of coke in by-product ovens is 23 to 25 per cent. greater with low volatile coals, and 7 to 8 per cent. greater with high volatile Pittsburgh coal; (2) The recovery from each ton of coal of 7 to 15 gals. of tar, benzol, toluol and other oils, 16 to 30 lbs. of sulphate of ammonia and surplus gas constitutes a great conservation of resources.

The Algoma Steel Corporation and the Steel Company of Canada operate respectively 160 and 100 by-product coke ovens, employing 339 men in 1920 and paying wages amounting to \$616,250. A total of 1,089,024 short tons of imported coal worth \$8,289,388 were used. Of the total blast furnace and foundry coke product mentioned hereunder, 55,727 tons worth \$493,715 were sold, the bulk being used in steel-making by the two producing companies. In the latter part of September the Steel Company of Canada commenced operating its new benzol plant. By the end of the year benzol by-products were being produced at the rate of 100,000 U.S. gallons per month from the operations of 100 ovens using 1,250 tons of coal daily.

Coke and coke oven by-products were produced as follows:

Schedule	Quantity	Value \$
Coke (Blast Furnace and Foundry)	725,214 tons	8,075,847
Ammonium sulphate	22,622,055 lbs.	849,935
Tar	8,029,936 Imp. gals	382,018
Gas	6,852,191 M. cu. ft.	593,239
Domestic coke	24,639 tons	62,009
Coke breeze	72,053 "	94,659
Benzol by-products	275,015 Imp. gals.	67,589
Total		10,116,296

Lead

The entire output noted in Table 1 was the product of the Kingdon Mining, Smelting and Manufacturing Company, with mine located at Galetta. There was, in addition, a recovery by United States refineries of 15,661 pounds from the refining of silver ores and gold slag. All the pig produced was consigned to the Jas. Robertson Co., Ltd., plumbing supply manufacturers, with head office in Montreal, Que. Average lead prices for the year were 7.96 and 7.83 cents per pound, respectively, on the New York and St. Louis markets.

NON-METALLIC MINERALS

Actinolite

Actinolite, a fibrous mineral akin to asbestos but of inferior quality, is used chiefly for roofing purposes. There is only one company operating in Ontario, namely: The Actinolite Mining Company, at Actinolite village, where a mill for treating the ore is operated as business demands. The deposits are located in the townships of Elzevir and Kaladar, Hastings county. In 1920 shipments from the mill were 100 tons valued at \$1,160. The head office of the company is at Bloomfield, New Jersey.

Barite

Crude barite (barytes or barium sulphate) when ground is used largely for paints and pigments including lithopone (barium sulphate and zinc sulphide), and also to a lesser extent for barium chemicals. Although only one trial shipment of barite was reported in 1920, there are in the Province several important deposits not being worked, principally due to their remoteness from transportation. During 1920 in the United States 238,113 tons of barite were marketed at an average price of \$9.39 per ton f.o.b. shipping point, a larger tonnage and higher price than recorded in any previous year. The bulk of the crude ore comes from the States of Missouri and Georgia.

In 1920 on lot 20, Concession X, township of North Burgess, some 7,000 tons of ore were proven and 200 tons, averaging 99.12 per cent. BaSO_4 , were mined by H. C. Bellew of Montreal, but no shipments were made.

The mill of the Premier Langmuir Mines, Ltd. in Langmuir township, near Porcupine, was not operated, due principally to company reorganization.

The Ravera deposit in Penhorwood township, district of Sudbury, is described by C. H. Hitchcock, mining engineer and geologist for Smith and Travers Company, Limited, Sudbury. The notes which follow are from Mr. Hitchcock's report dated September 30th, 1920:

Ravera.—This barite prospect consists of two mining claims (S. 4419 and S. 4421) in the township of Penhorwood, 3 miles west of Tionaga station on the Canadian National railway and $128\frac{1}{2}$ miles west of Capreol, Ontario. The Barite Syndicate prospected, diamond-drilled and mapped the claims. The railway passes through the property, and the distance from the track to the point where it is proposed to sink a shaft is 2,500 feet. The country is hilly and covered with a forest of pine, spruce, and balsam. Water is plentiful.

The rocks on the claims are mainly pre-Cambrian greenstones. This greenstone is cut by a pegmatite dike which has been pressed and sheared, the ferromagnesian minerals having largely altered to serpentine. A later fracturing along the strike of the dike made fissures which were filled with barite. The youngest rocks consist of diabase dikes which intrude the pegmatite.

The vein is from one to sixteen feet in width and has been proved by trenches and bore-holes for a length of 1,600 feet and a maximum depth of 130 feet. The impurities in the vein consist of blocks of pegmatite, calcite, quartz and fluorite. The last three minerals are found in or on the walls of the veins or around the blocks of pegmatite that in places occur in the veins. As there is very little inter-mixed barite, calcite, quartz or fluorite, the conditions are almost ideal for sorting. The barite is not stained with iron oxides and it contains practically no fluorite. The total length and depth of the vein have yet to be ascertained. Diamond-drilling in a sector of the vein 600 feet long and 100 feet deep shows 50,000 tons of barite analyzing 91 per cent. barium sulphate (BaSO_4). As the total length of the vein is unknown and as it continues below the 100-foot level, a conservative estimate of the barite available is 75,000 tons.

The work done on the property consists of pits, trenches and six diamond-drill holes, totalling 1,012 feet. There are no buildings, roads or equipment; but the railroad siding has been surveyed to a point suitable for sinking a shaft and for driving an adit level.

Ten channel samples taken on the surface across the width of the vein, which varies from 2 to 11 feet, assayed 94 to 98 per cent. BaSO_4 , the average being 95.5 per cent.

Forty pounds of material, taken from several different pits after blasting so as to get fresh mineral, were ground to 80-mesh and when analysed gave the following results:

	Mines Branch, Ottawa	Commercial Labora- tory.
	Per cent.	Per cent.
Barium sulphate (BaSO_4).....	97.5	96.45
Silica (SiO_2).....	2.28	0.90
Lime (CaO).....	Trace	1.14
Magnesia (MgO}).....	.....	0.12
FeO , Al O	0.0	0.14
Total.....	99.78	98.75

A trial shipment of 1,200 pounds of barite from various pits where blasting had been done was sent to the St. Joseph Lead Company, 61 Broadway, New York, and was reported to assay: Barium sulphate (BaSO_4) 96.14 per cent., and silica (SiO_2) 1.89 per cent.

Boreholes 1, 2, 3 and 5 cut a total of 38.6 feet of vein matter; of this, 29.3 feet was classified as barite and averaged 85.0 per cent. of barium sulphate. As a surface sampling showed 95.5 per cent. of barium sulphate and the core sampling 85.0 per cent., there is a difference of 10.5 per cent. in the two groups of samples. The boreholes may have penetrated impure portions of the veins; or the percentage of barite in the vein may be decreasing with depth and that of calcite increasing. However, the granite, calcite and quartz cored almost perfectly and the barite cored poorly. On the surface calcite weathers more readily than barite; so the true barium sulphate content lies somewhere between the core results of 85.0 and the channel sampling of 95.5 per cent.

The commodity freight rate on barite (crude ore), including the increase of 40 per cent. effective in August, 1920, is approximately one cent. per net ton per mile. The approximate rate to various Canadian points from Kutatash is as follows: Sudbury, \$1.50 per net ton; Toronto, \$4.05 per net ton; Niagara Falls, \$4.88 per net ton; Montreal, Que., \$6.00 per net ton.

Power for grinding purposes can be obtained at Sudbury, Ont., for \$25.00 per horsepower year.

The following is a list of the more promising mines and prospects:

BARITE MINES AND PROSPECTS

Property	Location.
Barite Syndicate, Sudbury.....	Penhorwood tp., Sudbury district.
Bellew, H. C., 6 St. Sacrement St., Montreal, Que....	Lot 20, Con. X, North Burgess tp.
Caldwell, Thos. B., Lanark.....	Lavant tp., Lanark Co.
Ontario Barium Co., H. J. Richmond, Sec.-Treas., 33 Victoria St., Toronto.....	Yarrow tp., Timiskaming district.
Premier Langmuir Mines, Ltd., 40 Bank of Toronto Bldg., London, Ont.....	Langmuir tp. (Connaught Sta.)
Silk, F. H., 275 St. George St., Toronto.....	Lawson tp., near Elk Lake.

Celestite

A deposit of this mineral (strontium sulphate, SrSO_4) on lot 7, concession X, Bagot township, has been worked by J. E. Wilder, 328 Bleury St., Montreal. In 1918 some 200 tons of ore were mined. In 1920 a trial shipment of 23 tons of ground celestite was made to the Dunlop Tire and Rubber Goods Company, Limited. It was stated that the product was too coarse, a fineness of 350-mesh being required. The paint trade also requires fine grinding. No further development, either in mining or grinding, has taken place.

Feldspar

The market for high potash feldspar in 1920 showed a marked improvement over 1919, owing to an increased demand from the pottery, porcelain and enamelware manufacturers of New Jersey and Ohio. These industries were quiescent during the war period and, owing to their being regarded as non-essential, their fuel supply was curtailed. The year was the most active in this industry on record. Seventeen producers made shipments totalling 37,335 tons valued at \$268,295. The industry employed 250 men, their wages totalling \$167,165.

During the year a deposit was opened up by W. B. Woods in Chapman township at Cecebe lake, an expansion of the Maganatawan river.

Feldspars, Limited, did not operate its two properties near Verona, where large tonnages are available, but an effort is being made to secure a branch line of railway for facilitating shipments.

The Feldspar Milling Company, Limited, moved its grinding mill from Tichborne to Ashbridge's Bay, Toronto, and commenced grinding at Toronto in November.

FELDSPAR PRODUCERS, 1920.

Name.	Location of Deposit.	P.O. Address.
Dillon and Mills.....	Lot 23, Con. VI, Monteagle tp.	Hybla.
Eureka Flint & Spar Co., The..	Verona.....	Trenton, N.J.
Federal Feldspar, Limited.....	Lot 25, Con. III, Bedford tp....	Central Chambers, Ottawa.
Feldspar Milling Co., Ltd.....	Grinding plant at Toronto.....	33 Richmond St. W., Toronto.
Feldspar Quarries, Limited.....	Portland tp.....	Toronto, 21 Manning Arcade Annex.
Feldspars, Limited.....	Verona.....	103 Bay St., Toronto.
Gardner, Wm.....	Lot 1, Con. I, Loughborough tp.	Hartington.
International Feldspar Co., Ltd.	Godfrey.....	158 Collingwood Ave., Detroit, Mich.
McConnell Consolidated Mines, Limited.....	Lot 10, Con. IV, Sherbrooke tp. (Morrow); Lot 3, Con. VII, Bathurst tp. (Kirkham).....	Perth.
O'Brien and Fowler.....	Lots 5 and 8, Cons. II and III, March tp.; Lot 11, Con. IX, Loughborough tp.....	17 Beech St., Ottawa.
Orser-Kraft Feldspar, Ltd.....	S. Sherbrooke tp., Feldspar station, C.P. Ry.....	34 Toronto St., Toronto.
Orser and Wilson.....	Lot 11, Con. IX, Loughborough tp.....	Perth Road.
Richardson & Sons, Jas.....	Lot 16, Con. II, Portland tp....	243 King St., Kingston.
Rock Products Company, The..	Lot 10, Con. VI, Bathurst tp....	1154 Nicholas Bldg., Toledo, Ohio.
Universal Silicates, Ltd.....	Lot 22, Con. VI, Monmouth tp.	Hybla.
Verona Mining Company.....	Con. VII, Monteagle tp.....	Hybla.
Woods, W. B. & McColl, John..	Lot 26, Con. II, Chapman tp....	Port Carmen.

Fluorspar

The demand for fluorspar has fallen off since the war, when open-hearth steel makers required a large supply. Shipping conditions on the railways have improved, and Ontario spar is not without competition. Careful cobbing is necessary if barite and other objectionable impurities are to be eliminated. Iron and steel makers require a spar carrying at least 80 per cent. of calcium fluoride and free from sulphides, sulphates and phosphites. "Acid" spar should contain not less than 98 per cent. calcium fluoride and not more than 1 per cent. silica. Ground fluorspar containing 92 to 98 per cent. calcium fluoride and 1 to 4 per cent. silica is suitable for the manufacture of opalescent glass, also enamel and sanitary ware.

Ontario's production comes entirely from Madoc in eastern Ontario. Both the Perry mine operated by Cross and Wellington and that of Canadian Industrial Minerals, Limited, the two principal shippers in 1920, were closed at the end of the year owing to lack of a market. Shipments in 1920 totalled 3,704 tons worth \$67,381, compared with 3,425 tons in 1919, valued at \$60,389, and 7,285 tons worth \$153,190 in 1918.

FLUORSPAR PRODUCERS, 1920.

Name.	Location.	Address.
Canadian Industrial Minerals, Ltd.	Huntingdon and Madoc tps.	Toronto, 1511 Bank of Hamilton Bldg.
Cross & Wellington.	Lot 11, Con. XIII, Huntingdon	Madoc.
Wallbridge, G. M.	Lot 1, Con. I, Madoc.	Madoc.

Graphite

Graphite mining in Canada is carried on in Ontario and Quebec, all within a radius of 150 miles of the city of Ottawa. The Black Donald mine, situated 12 miles west of Calabogie, in the county of Renfrew, is recognized as the largest and best grade deposit of graphite in America. The mine has been in operation since 1895. The graphite is micro-crystalline in structure, and is associated with metamorphic rocks. For the most part the graphite is fine-grained in which coarse flakes occur in aggregates.

Ontario's output of graphite in 1920 fell off considerably in common with other producing countries, namely: Ceylon, Madagascar and the United States. Crucible manufacture, the main outlet for the product, was inactive in sympathy with the steel trade. To comply with specifications for crucibles graphite must have 90 per cent. graphite carbon, be free from mica and pyrite, and the flake should be retained on an 80-mesh screen. Graphite is also used for lubricants, foundry facings, stove polish, etc. It is the most important solid lubricant, and both the crystalline and amorphous varieties are used for this purpose.

Prior to 1909 dry methods of concentration were employed with large losses. Early in 1919 the Black Donald mine began to use the flotation process with good success and the Spearman flotation process was installed at the Stanleyville plant of the Timmins company. In 1920 the total output of natural graphite in the United States was 9,510 tons, valued at \$626,202.

During 1920 the two Ontario companies mentioned hereunder milled 3,787 tons of ore and shipped 288 tons of crude worth \$13,066, and 1,668 tons of refined graphite valued at \$119,816. There was, in addition, a production of artificial graphite chiefly in the form of electrodes by the Acheson Graphite Company of Niagara Falls, Ontario, totalling 682 tons worth \$193,361. As all the raw products, with the exception of sawdust, which enter into the composition of artificial graphite were imported from the United States, the value of the finished products (electrodes and powdered graphite) has not been included in Tables I and II, pages 2 and 3.

GRAPHITE OPERATORS, 1920.

Company.	Location of Mine.	P.O. Address.
Black Donald Graphite Co., Ltd.	Brougham tp., Renfrew county	Calabogie.
Timmins Graphite Mines, The.	N. Burgess tp., Lanark county.	Stanleyville.

Iron Pyrites

With the close of the war the demand for pyrite for sulphuric acid manufacture suddenly slackened, and surplus stocks of acid were still being absorbed in 1920. Although the figures of pyrite shipments for 1920 show an increase over 1919, railway transportation conditions have improved to such an extent that native sulphur from the southern States is now a strong competitor with Ontario pyrite.

The first sulphuric acid plant in Canada was opened at London, Ontario, in 1866, the output being 50 to 60 tons per month, using sulphur from Sicily as the raw product. Its chief use at that time was in oil refining. Subsequently it came into use for the manufacture of muriatic, nitric, phosphoric and acetic acids; in tanning, milk-testing, glycerine and glue production; in treating lead, zinc, cobalt, and nickel ores; in tinning, galvanizing, plating and metal trades; as an electrolyte in storage batteries; paper-making; sulphating alumina and ammonia; acidifying phosphate rock, etc. In fact the use of sulphuric acid is so general in industry that the state of the market for this product may be regarded as a good trade barometer.

The Nichols Chemical Company, with mines at Sulphide, Northpines and Goudreau, is the largest Canadian producer. Shipments from Goudreau of 30 per cent. ore were from stockpile, the mine not having operated during the year. Ore from Northpines carrying forty per cent. sulphur was carried by rail to Fort William docks for shipment by boat. The Grasselli Company at Flower station, and the Canadian Sulphur Ore Company at Queensboro, shipped to the chemical plant at Hamilton belonging to the former company. Shipments to Sault Ste. Marie from stockpile at the Helen mine were made by the Algoma Steel Corporation. Of the total shipments 19,528 tons were consigned to Ontario points and 129,123 tons to the United States.

Following is a list of pyrite shippers in 1920:

IRON PYRITES SHIPPERS, 1920.

Name of Owner, Firm or Company.	Location or Name of Mine.	P.O. Address of Manager, etc.
Algoma Steel Corporation, Limited.	Helen.	Sault Ste. Marie.
Canadian Sulphur Ore Company, Ltd.	Queensboro.	Toronto, Crown Office Building.
Grasselli Chemical Co.	Caldwell.	Flower Station.
Nichols Chemical Co., Limited, The. . .	Goudreau.	Goudreau.
	Sulphide.	Sulphide.
	Vermillion lake.	Northpines.

Mica

Ontario's mica production comes chiefly from the eastern part of the Province. Returns show that sales for the year were 719 tons, worth \$54,169. The large tonnage is explained by the inclusion of 427 tons of scrap and dump mica worth \$5,683. Shipments were made of 263 tons of rough-cobbed worth \$38,177, and 57,049 lbs. of thumb-trimmed. Prices obtained for the last-mentioned variety ranged as follows:

Size.	Price per lb.	Size.	Price per lb.
1" x 1"	9c. to 15c.	2" x 4"	60c. to 90c.
1" x 2"	17c. to 20c.	3" x 5"	\$1.00 to \$2.50
1" x 3"	25c. to 35c.	4" x 6"	\$1.50 to \$3.50
2" x 3"	40c. to 50c.		

The Lacey is the most important deposit. From this mine shipments are made to the General Electric Company at Schenectady, N.Y.

The list of producers is as follows:

MICA PRODUCERS, 1920.

Name of Owner or Producer.	Location or Name of Mine.	P.O. Address of Manager, etc.
Adams, J. H.	N. Burgess tp.	Perth.
Bennett, Herbert V. ....	.....	Perth.
Cordick, S. J. ....	.....	Perth.
General Mica Mining Co.	McConkey tp.	Cleveland, Ohio, 9200 Lorain Ave.
Green, George.	Bedford tp.	Perth Road.
Kent Bros. and Estate J. M. Stoness.	Bedford tp.	Kingston.
Loughborough Mining Co., Ltd.	Lacey mine, Loughboro' tp.	Sydenham.
McLaren, W. L.	North Burgess tp.	Perth.
Tory Hill Marble & Mica Co.	Glamorgan tp.	Tory Hill.
H. L. Coombs Co., Ltd.	North Elmsley.	Perth, R.R. No. 5.

Mineral Waters

For the past few years there has been a slackening demand for mineral waters, due to temperance legislation. It is difficult to secure accurate figures, owing to a large part of the product being shipped in bulk to bottling works. Where bottling is done at the point of production, the value placed upon the sales is much higher than for the bulk article.

Below are tabulated figures since records were first secured in 1918:

Year	Sales		Employees	Wages \$
	Imp. Gals.	Value \$		
1918	208,498	133,808	45	20,708
1919	276,833	19,290	17	10,228
1920	127,150	15,059	20	10,643

SHIPPERS OF MINERAL WATERS, 1920.

Operator.	Location of Wells or Springs.	Brand of Water.	P.O. Address of Manager, etc.
Allan's, Limited.....	Caledonia Springs..	Caledonia Water...	86 Dorchester St. W., Montreal.
Belanger, Arthur.....	North Plantagenet, George Lake.	St. George.....	Papineauville, Que.
Borthwick, W.....	Hawthorne, Gloucester tp.....	Borthwick.....	48 Fourth Ave., Ottawa.
Caledonia Springs Co., Ltd., The	Caledonia Springs & Bourget.....	Magi, Duncan, Adanae.....	2716 St. Urban St., Montreal.
Canada Mineral Waters, Ltd ...	Bourget.....		65 Bellwoods Ave., Toronto.
Carlsbad, Limited, The.....	Carlsbad Springs...	Magi, Carlsbad, Lithia	Carlsbad Springs.
Denault Mineral Water.....	Bourget.....		Bourget.
Goderich Mineral Water Co....	Goderich.....		Goderich.
Gurd & Co., Limited, Charles...	Caledonia tp.....	Gurd's Caledonia Water.....	76 Bleury St., Montreal.
Sanitaris, Limited.....	Pakenham tp.....	Sanitaris.....	Arnprior.

Natural Gas

A full report, including statistics of production, appears as Part 5, Volume XXX, prepared by the Natural Gas Commissioner. In Table 1, page 2, the production and value are given.

Peat

At the Alfred bog, lots 7-9, con. VIII, Alfred township, Prescott county, experiments were continued by the Peat Committee, appointed jointly by the Provincial and Federal Governments. A report of operations appears on pages 167-170.

During the year 3,900 tons of peat fuel were marketed at \$4.00 per ton and 2,000 tons were on hand at the end of the year. Shipments were made to about twenty-five towns and cities, the largest tonnage being consigned to Ottawa.

Petroleum

A report by the Natural Gas Commissioner appears in Vol. XXX, Part 5. Crude petroleum production is given in Table I, page 2.

Quartz and Silica Brick

Production in 1920 includes 4,095 tons of silica brick (1,275,450) by the Algoma Steel Corporation. There was also a shipment of 561 tons of flint pebbles from Santoy near Jackfish on Lake Superior to the Canada Cement Company. Electro-Metals, Limited, of Welland, use the product of their quarry, in the manufacture of ferro-silicon.

Following is a list of quarry operators:

QUARTZ SHIPPERS, 1920.

Name of Owner, Firm or Company.	Location of Quarry.	P.O. Address of Manager, etc.
Electro-Metals, Limited.....	Killarney.....	Welland.
International Nickel Company of Canada Limited.....	Dill tp.....	Copper Cliff.
McPhail & Wright Construction Co.....	Bellevue, A. C. Ry.....	Sault Ste. Marie.
O'Brien and Fowler.....	March tp.....	Ottawa.
Todesco, C. W.....	Santoy.....	Jackfish.

Salt

Production was well maintained in 1920. Brine was pumped from twenty-six wells. The ten plants operated are all situated in the southwestern peninsula of the Province, between Kincardine on Lake Huron and Amherstburg on the Detroit river. Brine with salt equivalent of 93,712 tons was used in the chemical plant of Brunner Mond, Canada, Limited, at Amherstburg, and that of the Canadian Salt Company, Limited, at Sandwich. Chemicals produced include soda ash by the former company, while the latter turns out caustic soda and bleaching powder.

The following table gives details of Ontario's salt industry over a five-year period:

SALT STATISTICS, 1916—1920.

Schedule	1916	1917	1918	1919	1920
Land..... tons.	1,050	2,093	2,041	1,720	2,054
Coarse..... "	29,241	32,236	25,232	35,150	28,709
Fine..... "	56,325	56,028	53,908	47,571	39,663
Table and Dairy..... "	30,640	34,251	34,324	34,396	42,474
Brine (salt equivalent)"	11,679	14,301	16,221	29,275	93,712
Total Sales..... "	128,935	138,909	131,726	148,112	206,612
Value of Sales..... \$	700,515	1,047,707	1,287,039	1,395,368	1,544,867
Employees*..... No.	238	312	302	296	338
Wages..... \$	208,673	234,925	275,842	319,463	442,004

*Employees of chemical works are not included.

The list of companies producing brine or salt in 1920 was as follows:

SALT COMPANIES, 1920.

Name of Owner, Firm or Company.	Location of Wells or Works.	P.O. Address of Manager, etc.
Brunner, Mond Canada, Limited.....	Amherstburg*.....	Amherstburg.
Canadian Salt Company, Limited, The.	Windsor.....	Windsor.
Dominion Salt Company, Limited, The.	Sandwich*.....	
Exeter Salt Works Company, Limited...	Sarnia.....	Sarnia.
Goderich Salt Co., Limited.....	Exeter.....	Exeter.
Ontario People's Salt and Soda Co., Ltd.	Goderich.....	Goderich.
Western Canada Flour Mills Co., Ltd...	Kincardine.....	Kincardine.
Western Salt Company, Limited.....	Goderich.....	Goderich.
Wingham Salt Works (Young Estate)...	Courtwright.....	Courtwright.
	Wingham.....	Wingham.

*Chemical works using salt brine as raw material.

Talc

During the year three operating companies mined 24,411 tons of crude talc. Shipments included 5,228 tons of crude and 15,131 tons of ground talc, the total being 20,359 tons worth \$306,319 as compared with 17,571 tons valued at \$240,399 in 1919. In the late fall the Eldorado Mining and Milling Company went out of business, and efforts to secure statistics covering the number of men employed and wages paid were unsuccessful.

Statistics of the industry covering a five-year period are given herewith:

TALC STATISTICS, 1916—1920.

Schedule	1916	1917	1918	1919	1920
Crude talc shipped..... tons.	3,665	2,398	1,044	1,644	5,228
Ground talc shipped..... "	8,145	13,678	16,421	15,927	15,131
Total value shipments..... \$	111,489	179,554	246,691	240,339	306,319
Employees, mine and mill..... No.	60	56	43	87	60
Wages paid.....	32,434	49,734	41,936	76,384	77,818

The following companies and firms were engaged in the mining and milling of talc during 1920:

TALC OPERATORS, 1920.

Firm or Company.	Location of Mine or Works.	Address of Manager, etc.
Anglo-American Talc Corporation, Ltd..	Huntingdon tp.....	Madoc.
Eldorado Mining and Milling Co., Ltd..	Eldorado.....	Eldorado.
*Henderson Mines, Limited.....	Huntingdon tp.....	Madoc.
Geo. H. Gillespie and Company, Ltd....	Madoc (grinding mill)....	Madoc.

*The Henderson mine was operated under lease by Henderson Mines, Limited, the product going to the mill of Geo. H. Gillespie and Company.

In June, Raymond B. Ladoo, Mineral Technologist of the U.S. Bureau of Mines, paid a visit to Madoc in order to compare methods of mining and milling with practice employed in New York, Vermont and elsewhere in the United States. His investigations were published in September under the title "Talc Mining and Milling at Madoc, Ontario," and reproduced in the November issue of the *Canadian Chemical Journal*.

MATERIALS OF CONSTRUCTION

An idea of the activity in the building trades during 1920 as compared with the ten years preceding may be had from the figures presented in the February, 1921, issue of the *Labour Gazette*, published by the Department of Labour, Ottawa. Building permits for fifteen Ontario cities in 1920 totalled \$47,175,077, as compared with \$40,584,834 in 1919, and a maximum of \$20,229,574 for any year during the war period. The extraordinary activity shown during the building boom prior to the war reached its peak in 1912, and slackened abruptly in 1915, through the curtailing of all but essentially necessary construction. In 1912 and 1913, the best pre-war years, permits averaged nearly \$50,000,000 per year. Increases in valuation in 1920 as in 1919, must be interpreted in the light of increased cost of wages and building materials, although the last two months of the year showed some reduction along these lines. Building permits for twenty-five Ontario cities as reported by the *Labour Gazette* showed a total valuation in 1919 of \$46,816,790, and \$51,609,700 in 1920. Conditions are still so abnormal that comparison with pre-war years is made difficult.

Clay Products

Brick and Tile.—In the clay-working industries the year was marked by a small decrease in output but increased valuation as compared with 1919. The expected building boom in 1920 did not take place, chiefly due to hesitation on the part of builders who refrained from large scale house construction owing to high costs, unsettled labour conditions and the fear that a general decline in prices might result in heavy losses. There is still a marked shortage of housing accommodation, owing to the inactivity in building operations during the war period. Common brick, which sold at an average price of \$7.96 per M. in 1915 at the works, rose to \$13.92 per M. in 1919, and to \$17.88 per M. in 1920. There has been a decrease in the number of kilns operated, many of the smaller and less efficient plants going out of business. In 1913 there were 199 plants in operation as compared with 106 in 1920. The average period of operation in 1920 was 148 days, and the industry employed 1,793 men whose wages totalled \$1,772,494.

TABLE XIII.—OUTPUT AND VALUE OF CLAY PRODUCTS, 1920.

Product	Marketed		Stock on hand Dec. 31, 1920
	Quantity	Value \$	
Common Brick.....M	123,551	2,209,265	M 33,721
Pressed Brick.....M	21,429	483,627	M 6,620
Tapestry or Rug Brick.....M	11,130	325,499	M 3,512
Drain Tile.....M	9,784	359,373	
Hollow Building and Roofing Tile.....tons	58,737	369,530	
Pottery.....		127,049	\$12,575
Sewer Pipe.....		860,811	\$243,274

In the following table the value of clay products for the last pre-war year is given and also for each subsequent year:—

TABLE XIV.—VALUE OF CLAY PRODUCTS, 1913-20.

Year	Brick		Pottery	Drain Tile	Sewer Pipe	Total
	Common	Pressed Fancy, Building Tile, etc.				
	\$	\$	\$	\$	\$	\$
1913.....	3,283,894	1,114,410	52,875	292,767	600,297	5,303,181
1914.....	2,336,207	894,381	25,720	277,530	571,756	4,105,597
1915.....	763,591	375,865	49,387	321,253	361,283	1,871,370
1916.....	509,559	495,895	87,025	275,471	216,749	1,584,699
1917.....	713,824	776,302	94,501	546,040	379,923	2,509,590
1918.....	665,454	592,286	88,275	309,899	362,536	2,018,450
1919.....	1,966,711	726,500	119,551	354,700	609,100	3,776,562
1920.....	2,209,265	1,178,656	127,049	359,373	860,811	4,735,154

Average fuel prices as given in the table below show an advance over 1919 figures which were as follows: wood, \$6.92 per cord; coal, \$6.20 per ton; and natural gas, 22 cents per M. cubic feet:—

FUEL CONSUMPTION, BRICK AND TILE PLANTS, 1920.

Wood			Coal or Coke			Natural Gas		
Cords	Value		Tons	Value		M. c. ft.	Value	
	Total	Average per cord		Total	Average per ton		Total	Average per M
	\$	\$ c.		\$ c.	\$ c.		\$	\$ c.
33,866	252,715	7 46	87,768	968,470	11 03	81,344	21,515	0 26

Following is a list of the brick and tile operators who reported an output in 1920:—

BRICK AND TILE PLANTS, 1920.

Name.	Address.	Product.
Armstrong Bros.	Fletcher.	Tile.
Baird & Son, H. C.	Parkhill.	Brick, Tile and Blocks.
Beehtel, B. E.	Waterloo.	Brick.
Bond & Bird.	Woodstock, R.R. No. 5.	Common and Pressed Brick.
Booth Brick & Lumber Co., Ltd.	Islington, R.R. No. 1.	Common and Pressed Brick.
Boyd Pressed Brick Co.	Milton.	Pressed Brick.
Brampton Pressed Brick Co.	Brampton.	Pressed Brick.
Broadwell & Son, B.	Kingsville.	Tile.
Buck, J. L.	Port Rowan.	Brick, Tile and Blocks.
Bushell, Wm.	Toronto, 2 Gillespie Ave.	Brick.
Canadian Pressed Brick Co., Ltd.	Hamilton, 36 Sun Life Bldg.	Pressed Brick.
Clay Products Co.	Detroit, Mich.	Brick.
Cooper, W. H.	Hamilton, 52 Gage Ave. N.	Brick.
Crang, Jethro.	Toronto, 202 Oakwood Ave.	Brick.
Curtin, Frank.	Lindsay.	Brick.
De Laplante, J. E. & Co.	Toronto, 111 Galt Ave.	Brick.
Deller, Albert E.	Vienna.	Brick, Tile and Blocks.
Deller & Sons, Geo.	Norwich, R.R. No. 2.	Brick, Tile and Hollow Blocks.
Deller, Wm. H.	Thorndale, R.R. No. 4.	Tile and Blocks.
Dochart Brick & Tile Works.	Arnprior.	Brick, Tile and Blocks.
Dolan, John.	Watford, R.R. No. 2.	Tile.
Dominion Sewer Pipe & Clay Industries, Ltd.	Aldershot and Swansea.	Brick.
Don Valley Brick Works.	Toronto, 714 Dominion Bank Bldg.	Common, Pressed and Tapestry Brick.
Elliott, Charles.	Bluevale.	Brick and Tile.
Elliott, Wm.	Glenannan.	Brick and Tile.
Elliott & Sons, Jas.	Sault Ste. Marie, 519 Wellington St. N.	Brick and Tile.
Erie Clay Products Co.	Port Dover.	Brick, Tile and Blocks.
Essex Brick Works, Ltd.	Detroit, Mich., Room 301, 113 State St.	Brick and Tile.
Fox, Geo. J.	Dresden.	Brick.
Frid Bros.	Hamilton.	Brick.
Gardiner, William.	Blenheim.	Brick and Tile.
Godfrey & Co., Thos.	Blenheim.	Brick and Tile.
Hallatt & Son, H.	Comber.	Brick and Tile.
Halton Brick Co., Ltd.	Terra Cotta.	Pressed Brick.
Hamilton Pressed Brick Co., Limited.	Hamilton, Kensington Ave. S.	Pressed Brick.
Hill, Aaron.	Essex.	Tile.
Hill, A. W.	Coatsworth, R.R. No. 1.	Tile.
Hinde Bros.	Mount Dennis.	Brick.
Hitch, Mrs. Susan.	Ridgetown.	Brick and Tile.
Hohl, John.	Wellesley, R.R. No. 1.	Brick and Tile.
Holland & Son, William.	Ruseomb.	Tile.
Howlett, Fred.	Petrolia.	Tile.
Interprovincial Brick Co. of Canada, Ltd.,	Toronto, 30 Toronto St.	Pressed Brick.

BRICK AND TILE PLANTS—*Continued.*

Name	Address	Product
Jackson Bros.	Brantford	Brick.
Janes, D. A.	Mt. Brydges	Brick and Tile.
Jamieson Lime Co.	Renfrew	Brick and Tile.
Jeffrey, Leon	Zurich, R.R. No. 2	Brick and Tile.
Jervis & Son, John	Dorchester Station	Brick and Tile.
Koebel, Joseph Z.	St. Clements	Brick and Tile.
Kruse Bros.	Seaforth, R.R. No. 3	Tile.
Kuhn, Henry J.	Centralia, R.R. No. 2	Tile.
Labey & Son, Geo. A.	Foxboro'	Tile.
Leamington Brick & Tile Co.	Leamington	Brick and Tile.
Lethbridge Brick Co., Ltd.	Sault Ste. Marie	Brick.
Lowes, Gordon	Chatham, R.R. No. 3	Brick and Tile.
MacKay Bros.	Dutton	Tile.
Martin, David	Thamesville	Tile.
McCormick Bros.	Watford, R.R. No. 5	Brick and Tile.
McCredie, W.	Belmont, R.R. No. 3	Tile.
McIvor Bros.	Cobourg, Box 636	Brick.
McLoughlin, Jno.	London, 1044 William St.	Brick.
Middleton, Chas.	Wyoming	Tile.
Milton Pressed Brick Co., Ltd.	Milton	Pressed and Rug Brick.
Miner, J. T.	Kingsville, R.R. No. 2	Tile.
Napanee Brick & Tile Co.	Napanee	Brick and Tile.
National Fire Proofing Co. of Canada, Ltd.	Toronto, 601 Dominion Bank Bldg.	Brick, Tile and Blocks.
New, Edward	Hamilton, Dundas Rd.	Brick.
Norton, Alsey	Bolton	Tile.
Odell & Sons, Wm.	Ingersoll	Brick, Tile and Blocks.
Ontario Brick & Tile Plant	Mimico	Brick, Tile and Blocks.
Ontario Paving Brick Co., Limited	West Toronto	Brick.
O'Reilly, T. E.	Ottawa, 320 Bay St.	Brick.
Ott Brick & Tile Mfg. Co., Limited, The	Kitchener	Brick and Tile.
Ottawa Brick Mfg. Co., Limited, The	Ottawa, 53 Queen St.	Brick.
Owen Sound Brick Co., Limited, The	Owen Sound	Brick.
Paxton & Bray	St. Catharines, Queenston St.	Brick.
Pears & Son, James	Toronto, Eglinton Ave. W.	Brick.
Pembroke Brick Co., The	Pembroke	Brick.
Phillips & Son, Thos.	Lucknow, R.R. No. 2	Tile.
Phippen & Field	Toronto, Dawes Road	Brick.
Port Credit Brick Co., Limited, The	Toronto, 307 McKinnon Bldg.	Common and Pressed Brick.
Price & Smith	Toronto, 490 Greenwood Ave.	Brick.
Price, Ltd., Jno.	Toronto, 100 Greenwood Ave.	Brick.
Richardson & Son, James	Kerwood	Brick and Tile.
Sarjeant Co., Ltd., The	Orillia	Brick.
Sadler, F. L.	Dublin	Brick and Tile.
Shale Brick Co. of Canada, Ltd., The	Cooksville	Brick.
Snelgrove, A.	Beaverton	Brick and Tile.
Sproat, Wm. M.	Seaforth, R.R. No. 4	Brick and Tile.
Standard Brick Co., Ltd.	Toronto, 498 Greenwood Ave.	Brick.
Stroh, M. C.	Conestogo	Brick and Tile.
Sudbury Brick Co., Ltd.	Sudbury	Brick.

BRICK AND TILE PLANTS—*Continued.*

Name	Address	Product
Sun Brick Co.,	Toronto, 32 Toronto St.	Brick and Blocks.
Superior Tile Co., Limited.....	Fort William.....	Common and Tapestry Brick.
Toronto Brick Co.	Toronto, 60 Victoria St.	Brick.
Wagstaff & Co., A. H.	Toronto, 336 Greenwood Ave.	Brick.
Waide, J. C.	London, 1010 Adelaide St.	Brick.
Waite, John E.	Forrester Falls.....	Brick and [Tile.]
Wallace & Son, R.	North Bay.....	Brick.
Warwick Brick Works.....	London, 647 Grosvenor St.	Brick.
Winch Bros.	Paisley.....	Brick and Tile.
Windsor Brick & Tile Co.	Windsor, 61 Pitt St. E.	Brick, Tile and Blocks.
Woodslee Brick & Tile Co.	S. Woodslee.....	Brick and Tile.
Wright, J. C.	Proton.....	Brick.
Wright & Sons, Geo.	Comber.....	Tile.
Yack, Norman A.	Walkerton.....	Brick and Tile.

Pottery.—Little advance is noticeable in Ontario's pottery trade. At present, production is confined to the rougher grades (flower pots, glazed crockery, etc.) made from domestic (glacial) clays. Fireclays are imported for the manufacture of "stone" ware and refractory linings for stoves. The total value of goods marketed, less the cost of imported clays, was \$127,049. The industry employed 46 men whose wages totalled \$55,256.

Following are the operators reporting a production in 1920:—

POTTERY MANUFACTURERS, 1920.

Name.	Address.
R. Campbell's Sons.....	100 Locke St. South, Hamilton.
Davis & Son, John.....	691 Merton St., Toronto.
Foster Pottery Company.....	Main St. West., Hamilton.

Sewer Pipe.—The value of marketed products was \$860,811, an increase of forty-one per cent. over the 1919 output of \$609,100. Production in 1920 was valued at \$887,504 and stock on hand at the end of the year \$243,274. In 1913, the last pre-war year, the value of the output was \$600,297. There are only three companies operating in Ontario as noted below:—

SEWER PIPE WORKS, 1920.

Name of Company.	Location of Plant.	P.O. Address of Manager, etc.
Dominion Sewer Pipe Co., Ltd.	Swansea.....	Swansea.
Hamilton & Toronto Sewer Pipe Co., Ltd. .	Hamilton.....	Hamilton.
Ontario Sewer Pipe & Clay Products, Ltd. .	Mimico.....	Mimico.

In 1920 the industry employed 264 men, whose wages amounted to \$320,880. Fuel consumption was 220 cords of wood and 16,498 tons of coal and coke, the total value being \$204,950..

On May 8th, 1920 the Toronto Sewer Pipe Company, Limited, with office at 220 Spadina Avenue, Toronto, received a Provincial charter, the capital being \$100,000. This is not a producing company, its business being that of selling agent for the other operators.

Gypsum

In 1920 there was only one operator, the Ontario Gypsum Company, Limited, whose head office is at Paris, Ontario. The two deposits of this company are situated in the valley of the Grand river, townships of Seneca and Oneida, with calcining works at Lythmore and Caledonia. During the year 84,178 tons were mined and milled. Crushed gypsum is used in the Portland cement industry. The calcined product is supplied to manufacturers and roofers, while wall plaster, gypsum blocks and plaster board are used for construction purposes. Crushed, ground and calcined gypsum marketed were 32,025, 453 and 13,485 tons respectively, or a total of 45,963 tons valued at \$159,838. In the manufacture of gypsum products 28,744 tons of calcined gypsum worth \$244,324 were used. Thus the total sales were \$74,707 tons worth \$104,162, as compared with 59,899 tons valued at \$278,111 in 1919.

In the United States during 1920, gypsum mined exceeded three million tons, the largest production on record, and the total value of crude and calcined gypsum marketed exceeded twenty-four and one-half million dollars, an increase in output of twenty-nine per cent, and in valuation of fifty-six per cent., the latter being due to greater production costs and the rapid increase in the quantity of gypsum board manufactured in recent years.

Portland Cement

Five plants for the manufacture of Portland cement were in operation in 1920, the same number as in 1919. The Canada Cement Company, Limited, has six plants in Ontario, only three of which were operated, while plants No. 6 at Marlbank, No. 9 at Shallow Lake, and No. 7 at Lakefield were idle. The last-mentioned plant was being re-constructed. During the war the capacity of the Hanover plant was increased from 700 to 1,200 barrels per day, and a change-over made from marl to limestone. The National Portland Cement Company of Durham ceased operations in December, 1919, the assets being taken over by the Standard Bank of Canada. The stock on hand (11,258 barrels) was sold during 1920. The Ontario Portland Cement Company, with plant at Blue Lake, near Brantford, went into liquidation in 1919, and was succeeded by the Ontario Cement Company, Limited, which purposes operating at Beachville.

Following is a list of the operating plants:—

PORTLAND CEMENT PLANTS OPERATING IN 1920

Company.	Location of Plant.	Head Office Address.
Canada Cement Company, Ltd.		Herald Bldg., Montreal,
Plant No. 4.	Thurlow tp.	Que.
Plant No. 5.	Thurlow tp., near Belle-	
	ville.	
Plant No. 8.	Port Colborne.	
Hanover Portland Cement Co., Ltd., The.	Hanover.	Hanover.
St. Marys Cement Co., Limited.	St. Marys.	St. Marys.

The capacity of the plants operated during the year was 12,500 barrels per day. An average of 859 men were employed, and wages amounted to \$1,283,357.

The following table gives details of the industry in 1913, during the war period and subsequently:—

PORTLAND CEMENT STATISTICS, 1913-1920.

Year	No. of Operating Plants	Stock on hand Dec. 31st bbls.	Sales		Average Price per bbl. \$
			Barrels	Value \$	
1913	13	450,213	3,802,321	4,105,455	1 08
1914	11	846,562	2,665,650	2,931,190	1 10
1915	7	755,799	2,302,242	2,534,537	1 10
1916	7	380,458	2,143,949	2,242,433	1 05
1917	6	567,261	2,063,231	2,934,271	1 42
1918	4	473,184	1,226,244	1,910,839	1 56
1919	5	278,188	2,022,575	3,659,720	1 81
1920	5	248,142	2,035,594	4,377,814	2 15

Reference was made in the last annual report to the introduction into Canada of "super cement," a new waterproof variety, produced by the introduction of gypsum and a catalytic colloid in the ordinary process of Portland cement manufacture. "Super cement" mortar is claimed to be waterproof, oilproof, and although slower setting, to be eventually stronger than ordinary Portland cement mortar. In 1920 the St. Mary's Cement Company, Limited, manufactured and sold 8,807 barrels of this product for the Canadian Company known as Super Cement (America) Limited, 23 Scott Street, Toronto. The cost to the consumer of this product is about one dollar per barrel more than the price of Portland cement.

The potash recovery plant at the Port Colborne mill of the Canada Cement Company had not reached the producing stage at the close of 1920. Experiments were still being conducted with the object of perfecting the new installation.

Cement Products.—Materials considered in this report are moveable concrete products as distinguished from monolithic concrete construction. Operations for the most part are on a small scale to meet local requirements. Information secured from operators is supplementary to the reports on cement, stone, sand and gravel, and in order to avoid duplication, the statistics of output are not included in the summary (page 2) of mineral production of the Province.

In all the products Portland cement is used as a binder. Brick conform in size and shape to the standard clay product. Architectural concrete stone, including caps and sills, is produced in various shapes and sizes to serve the same purpose as natural cut stone and terra cotta in the facings and trimmings of buildings. Blocks are usually hollow and moulded by hand or machine. Fence posts, silo blocks and staves, and concrete tile for drains, are in common use about the farm. Large sizes of tile are used for culverts and sewer pipe. Owing to the variety of sizes, quantities are given for brick and tile only. In 1920 cement brick to the number of 572,000 and 980,000 tile were produced. As in 1919, the cost of cement ranged high and retarded production considerably.

Detailed statistics for the past five years are given in the tabular statement hereunder:—

CEMENT PRODUCTS STATISTICS, 1916-1920.

Schedule.	1916	1917	1918	1919	1920
Cement brick	10,684	1,420	1,290	10,631	11,117
Cement blocks, sills, caps, etc.					
Cement drain tile, culvert tile and sewer pipe.	46,946	90,586	81,351	142,072	338,286
Value of total output	57,630	100,318	124,003	300,598	732,397
Average period of operation days	109	105	122	108	161
Employees	73	105	72	148	218
Wages	15,513	28,641	25,901	90,653	212,014

The following list gives the names and addresses of manufacturers of cement products reporting an output during the year:—

MANUFACTURERS OF CEMENT PRODUCTS, 1920.

Name.	Address.	Product
Andrews, S. J.	Clinton	Blocks and Tile.
Art Granite Company.	Essex	Blocks and Tile.
Bawden, Frederick W.	Exeter	Blocks.
Beam, P.	Port Colborne	Blocks.
Bowers, E.	Cottam	Blocks and Tile.
Boyd, H.	Osgoode	Blocks and Tile.
Brown, D. L.	Sudbury	Bricks, Blocks and Tile.
Bungalow Brick Company Limited.	Toronto, 143 Royce Ave.	Brick.
Burkholder, Geo.	Whitevale	Brick and Tile.

MANUFACTURERS OF CEMENT PRODUCTS—*Continued.*

Name	Address	Product
Canadian Concrete Products Co., Ltd.....	Chicago, Ill., 521 People's Gas Bldg.....	Blocks and Tile.
Cast Stone Block & Machine Co.....	Windsor, 1436 Howard Ave.....	Brick and Blocks.
Christie, Chas. R.....	Lindsay, 61 Bond St....	Brick, Blocks and Tile.
Concrete Pipe & Products Co., Ltd.....	Hamilton, York St.....	Brick, Blocks and Tile.
Clarkson Cement Tile & Brick Co.....	Clarkson.....	Brick, Blocks and Tile.
Crewe Bros.....	Merlin.....	Blocks.
Cross Builders Supply Co.....	Windsor, 924 Windsor Ave.....	Blocks.
Deline, L.....	Enterprise.....	Blocks and Tile.
Eldridge, Geo.....	Sarnia.....	Blocks.
Elliott, J. A.....	Dunsford, R.R. No. 1...	Blocks.
Fletcher, J. H.....	Fonthill.....	Blocks.
Gillies, Alfred.....	Galt.....	Brick and Blocks.
Granite Concrete Block Co., Ltd.....	Mt. Dennis.....	Blocks.
Hetherington, Isaac.....	Sheppardton, R.R. No. 1	Tile.
Hewitt & Son, A. B.....	Princeton, R.R. No. 3...	Blocks and Tile.
Independent Concrete Pipe Co.....	Woodstock.....	Tile.
Keeler, H.....	Spencerville.....	Brick.
Kinzel & Son, Jos.....	Preston.....	Blocks and Tile.
Kolbe & Co., W. F.....	Port Dover.....	Blocks and Tile.
Oil Springs Tile & Cement Co.....	Oil Springs.....	Tile.
Orde, Jno. A.....	Guelph, R.R. No. 3.....	Tile.
Osterhout, Peter.....	Windsor.....	Blocks and Tile.
Page, Geo. G.....	Lucknow, R.R. No. 3...	Tile.
Peerless Artificial Stone, Ltd.....	Toronto, Coxwell Ave. and G.T.R. Tracks...	Tubs.
Pfaff, W. E.....	Hensall.....	Blocks and Tile.
Prast, Frank.....	Hanover.....	Blocks and Tile.
Ridgeville Concrete Works.....	Ridgeville.....	Brick, Blocks and Tile.
Robinson, Edward.....	Mitchell, R.R. No. 3....	Tile.
Ross, Charles & Son.....	Dunnville.....	Tile.
Schram, A. J.....	Camlachie.....	Tile.
Showell, P. W.....	Owen Sound, R.R. No. 6	Blocks and Tile.
Smithson, F.....	Leamington.....	Blocks and Tile.
Taylor & Hall.....	Peterborough.....	Blocks and Tile.
Watts, Alfred.....	Tillsonburg.....	Blocks.
White, Homer & Co.....	Pictou.....	Brick, Blocks and Tile.
Williams, E. J.....	Wheatley.....	Blocks and Tile.

Lime

Production in 1920 shows an increase of over a million bushels, as compared with 1919. Details of the industry for the past four years are given hereunder:—

LIME STATISTICS, 1916-1920

Year	Production						Fuel Cost \$	Em- ployees	Wages \$
	Hydrated			Total Lime					
	Tons	Total Value \$	Per Ton \$	Bush.	Value \$	Ave. Price per bush. c.			
1917.....				2,820,507	657,364	23.3		325	262,132
1918.....				2,650,287	872,177	32.9	237,425	287	300,746
1919....	30,454	307,342	10.09	3,991,572	1,268,290	32.4	302,144	363	366,686
1920....	28,591	397,305	13.89	4,982,911	1,799,763	36.2	546,604	448	568,513

In 1917 and subsequently, the lime made and used by chemical works such as the American Cyanamid Company; Brunner Mond Canada, Limited (alkali makers) and the Dominion Sugar Company, has been included in statistics of production. In 1920 approximately fifty per cent. of the total output was used in this way. Owing to the increasing use of hydrated lime with cement mortar and concrete, the demand will doubtless increase considerably. The present-day tendency is to produce more hydrated lime, consequently many of the smaller kilns that formerly made quicklime for local use are being abandoned.

Below are given the names of producers and the location of plants operated in 1920:—

LIME PRODUCERS, 1920.

Name of Owner or Company.	Location of Kilns.	Head Office Address.
Alabastine Co., Paris, The.....(*)	Elora.....	Paris.
American Cyanamid Co.....	Niagara Falls.....	Niagara Falls.
Beachville White Lime Co., Ltd.....	Beachville.....	Beachville.
Bergin, Patrick.....	Napanee.....	Napanee.
Brunner Mond Canada, Limited.....	Anderdon tp., near Am- hertsburg	Toronto, Bank of Com- merce Bldg.
Canada Lime Co.....	Coboconk.....	Lindsay, R R. No. 2.
Chalmers & Campbell.....	Owen Sound.....	Owen Sound.
Chesnut, W. D.....	Nottawasaga tp.....	Duntroon.
Christie, Henderson & Co., Limited.....(*)	Hespeler, Galt, Puslinch, Kelso.....	Toronto, 201 Crown Office Bldg.
Delta Lime Co., Limited.....	Delta.....	Delta.
Flieler, Edward.....	Clarendon.....	Fernleigh.

LIME PRODUCERS—*Continued.*

Name of Owner or Company	Location of Kilns	Head Office Address
Gallagher Lime & Stone Co., Limited.....	Barton tp.....	Hamilton.
Gow, James.....	Melville Junction.....	Fergus.
Harvey, E., Limited.....	Rockwood.....	Guelph.
Jamieson Lime Co.....	Renfrew.....	Renfrew.
Parks Bros.....	Beverley tp.....	Troy.
Robertson Co., D., Limited.....	Nassagaweya tp.....	Toronto, 26 Queen St.E.
Smith, John S.....	Inverhuron.....	Inverhuron.
Standard Chemical Co., Limited.....	Eganville.....	Toronto, 1104 Royal
Standard White Lime Co., Limited.....(*)	Beachville, Guelph, St. Marys.....	Bank Bldg. Guelph.
Toronto Brick Co., Limited.....	Coboconk.....	Toronto, 60 Victoria St.
Toronto Lime Co., Limited.....(*)	Dolly Varden.....	Toronto, 26 Queen St. E.
Toronto Plaster Co., Limited, The.....(*)	Teeswater.....	Teeswater.
Weppler, Henry.....	North Durham tp.....	Priceville, R.R. No. 2.

*Producers of hydrated lime.

Sand-Lime Brick

Brick are made from sand and lime by compressing these materials in moulds and subjecting the resulting product to a steam bath. These brick will not stand rough handling before they are well cured. They find a ready market, particularly as inside brick, the cost being less than for the clay product.

Six plants operated in 1920, for an average of 221 days. The industry gave employment to 146 men, whose wages totalled \$154,502. Coal consumption was 4,579 tons worth \$43,223. The yearly capacity of the six plants is 59,888 M. brick. Production in 1920 was 27,656 M. and sales 27,503 M., worth \$407,766, or an average of \$14.72 per thousand, as compared with \$17.88 per M. for common clay brick. Stock on hand at the end of the year was 6,375 M.

The following plants were operated during the year:—

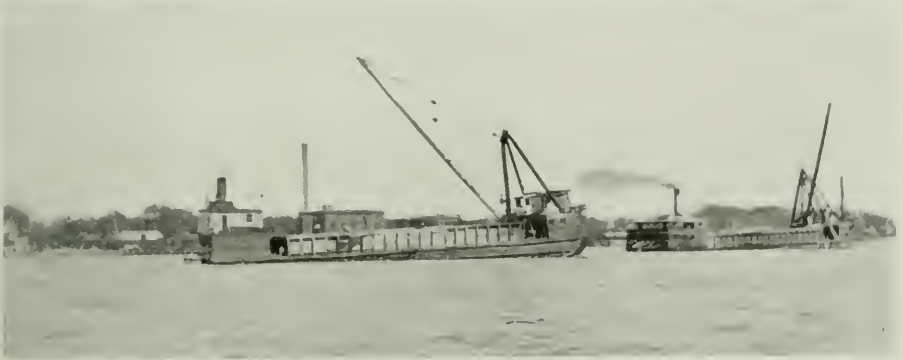
SAND-LIME BRICK PRODUCERS, 1920.

Name.	Location of Plant.	Address.
The Hepworth Silica Pressed Brick Co., Ltd.	Hepworth.....	Hepworth.
The Schultz Bros. Co., Ltd.....	McMurray St. Brantford	49 Albion St., Brantford.
Toronto Brick Co., Limited.....	Scarboro and Swansea...	60 Victoria St., Toronto.
Willcox Lake Brick Co., Ltd.....	Whitechurch tp.....	Richmond Hill.
York Sandstone Brick Co., Ltd.....	Gerrard St. and Victoria Ave., E. Toronto.	Toronto, 142 Annette St.

Sand and Gravel

During 1920 sand and gravel removed from pits and beaches totalled 697,474 cubic yards, and by dredging and sand-sucking operations 1,464,767 cubic yards. These figures do not include materials used for railway ballast, of which no record is kept.

Under authority of the Public Lands Act, and the Beach Protection Amendment Act, 1920, licenses are issued by the Ontario Government for the removal of sand, gravel and stone from the beds of the Great Lakes and other navigable waters. In addition to license fees and rentals of \$2,803, royalties amounting to \$96,850, or an average of 14 cents per cubic yard were paid in 1920 on 690,371 cubic yards of sand and gravel dredged. No royalty is collected on some of this material, more particularly water lots in the vicinity of Point Pelee in Lake Erie which are privately owned.



Self-loading boats dredging gravel below tunnel, St. Clair river.



Vessel leaving dredge after being loaded, St Clair river

SAND AND GRAVEL STATISTICS, 1920.

Source	Sand		Gravel		Employees	Wages \$
	cu. yds	Value \$	cu. yds.	Value \$		
Pits and Beaches.....	385,874	392,550	311,600	167,270	172	199,888
Great Lakes and Rivers..	179,047	70,272	1,285,720	760,612	448	306,268
Total.....	564,921	462,822	1,597,320	927,882	620	506,156

Following is a list of sand and gravel pit operators who marketed or used 1,000 cubic yards or more during the year:—

SAND AND GRAVEL OPERATORS, 1920.

Name of Owner or Company	Material G—Gravel S—Sand	Location of Deposits	Address
Aldborough, Township of.....	G.	Aldborough tp., lot A, con. 7.....	Rodney.
Armstrong Supply Co., Ltd., The..	S.	1143 York St., Hamilton.....	34 James St. N., Hamilton
Baxter, Jas.....	G.	Dereham tp., lot 17, con. X.....	Brownsville, R.R. No. 1.
Bellyou, Norman E.....	S. and G.	Murray tp., lot 6, con. 1.....	Trenton, R.R. No. 4.
Benson & Patterson.....	S. and G.	Stamford tp.....	Stamford.
Canadian Steel Corp'n, Ltd.....	S.	Ojibway.....	Ojibway.
Constructing & Paving Co. of Ont., Ltd.....	S. and G.	Erie tp.....	Toronto, 708 Confederation Life Bldg.
Downey, I. J. & Sons.....	G.	Garden River.....	Sault Ste. Marie.
Ellins Sand & Gravel Co.....	S. and G.	Sherkston.....	219 Scarlett Rd., Toronto
Empire Limestone Co.....	S.	Humberstone tp.....	Buffalo, N.Y., 19 Hudson St.
Godson Contracting Co., Ltd.....	S. and G.	Brock tp., lot 12, con. IV.....	Toronto, 113 Manning Chambers.
Hamilton, Joseph C.....	S. and G.	Stafford tp.....	Pembroke.
Hamilton Sand & Gravel, Ltd.....	S. and G.	Burlington Heights.....	Hamilton, 110 Queen St. N.
Homer White & Co.....	S. and G.	.....	Spring St., Picton.
Hydro-Electric Power Commission..	S.	Stamford.....	Box 245, Niagara Falls.
Kerr, Estate of John.....	G.	Enniskillen tp.....	Petrolia.
Kilbourne & Son, Harvey.....	S.	Westminster tp., Wharnccliffe Rd.....	London, 9 Cove Road.
Kingston Sand & Gravel Co.....	S.	Kingston tp.....	Kingston, R.R. No. 5.
Larter, Chas.....	S. and G.	Waterloo tp., N. of Galt.....	Galt, 76 Chambers St.
Lyons Fuel & Supply Co.....	G.	Mile 34, A.C. Ry.....	Sault Ste. Marie, Ont.
Maple Sand, Gravel & Brick Co....	S. and G.	Vaughan tp., lots 21-24 con. III.....	Toronto, 484 King St. W.
McPhail & Wright Construction Co.	S.	Korah tp.....	Sault Ste. Marie.
Neville & Son, Thos.....	S. and G.	Malahide tp., lot 7, con. 5.....	Aylmer, R.R. No. 5.
Oakland Sand & Gravel Co.....	S. and G.	Oakland tp.....	Niagara Falls.
Ontario Highways Dept.....	S. and G.	.....	Parliament Buildings, Toronto.
Paris Sand & Gravel Co.....	S. and G.	Dumfries tp., lot 30, con. I.....	Paris, R.R. No. 2....
Ponsford, A. E.....	S. and G.	Yarmouth tp., lot 1, con. VIII.....	St. Thomas, 605 Talbot St.
Sand & Supplies, Ltd.....	S. and G.	Dumfries tp., lot 30, con. IX.....	Toronto, 19 Melinda St.
Superior Sand & Gravel Co.....	G.	Point Edwards.....	Detroit, Mich., 926 Dime Bank Bldg.
Windsor, Essex & Lake Shore Ry. Co.....	G.	Mersea tp., W. of Leamington.....	Kingsville.
Windsor Sand & Gravel Co., Ltd., The.....	S. and G.	Two miles west of Leamington.....	Windsor, 57 Hall Ave.
York Sand & Gravel Co., Ltd.....	S. and G.	Gerrard St. E. and Victoria Park Ave..	Toronto, 1327 Bloor St. W.

The following carried on dredging operations under license:

SAND AND GRAVEL LICENSES, 1920.

Name of Company.	Material. G—Gravel. S—Sand.	Location of Deposit.	Address.
Cadwell Dredging Co., Ltd.....	G.	Lake Erie, off Point Pelee.....	Windsor.
Chatham Sand & Gravel Co.....	S. and G.	Thames River.....	Chatham.
Chick Contracting Co.....	G.	St. Clair River.....	Windsor.
Cameron Steamship Co.....	G.	St. Clair River.....	Detroit, 39 Buhl Bldg.
Department of Railways & Canals..	G.	Niagara River.....	Ottawa.
Great Lakes Transportation Co....	S.	Lake Superior.....	Fort William.
Hadley Co., Ltd., The C. & J.....	S. and G.	Thames River.....	Chatham.
Homegardner Sand Co.....	S.	Dummy Foundation, Lake Erie.....	Sandusky, Ohio.
International Sand & Gravel Co....	G.	St. Clair River.....	Detroit, 47 Campau Bldg
Lake Erie Sand Co.....	S.	Dummy Foundation, Lake Erie.....	Sandusky, Ohio.
Marysville Land Co.....	G.	St. Clair River.....	Marysville, Mich.
McLean & Son, A. B.....	G.	Head of St. Marys River.....	Sault Ste. Marie.
National Sand & Material Co.....	S. and G.	Lakes Erie and Ontario.....	Welland.
Niagara Sand Co.....	S.	Niagara River.....	Toronto, 408 Lumsden Bldg.
Niagara Sand Corporation.....	G.	Niagara River.....	Buffalo, N.Y., 907 White Bldg.
Ontario Gravel Freightng Co.....	G.	St. Clair River.....	Windsor.
Port Huron Sand & Gravel Co.....	G.	St. Clair River.....	Port Yuron, 801 Water St.
Superior Sand & Gravel Co.....	G.	St. Clair River.....	Detroit, 925 Dime Bank Bldg.
United Fuel & Supply Co.....	G.	St. Clair River.....	Detroit, Fress Press Bldg.

Stone

As indicated in the accompanying table the output of stone in 1920 shows a marked increase over preceding years, particularly as regards limestone and granite. The industry afforded employment to 961 men, whose wages totalled \$1,037,832. Producers of limestone whose output was in excess of \$100,000 in value are given in order: Hydro-Electric Power Commission, Canada Crushed Stone Corporation, Point Anne Quarries, Department of Highways, Brunner Mond, and the Michigan Central Railway. The first-mentioned used stone valued at over one million dollars in connection with the Chippawa power development scheme. Trap rock was used extensively in Toronto harbour improvements, while granite was in demand for paving purposes.

Following are the names of quarry operators reporting a production for 1920, classified according to product:—

STONE QUARRIES, 1920.

Name of Owner, Firm or Company.	Location	Kind of Stone.
Aybrams, J. M.	Gananoque	Limestone.
Ball & Sons, Henry C.	Grantham tp.	Limestone.
Bancroft Marble Quarries, Limited	Dungannon Tp.	Marble.
Beachville White Lime Co.	Beachville	Limestone.
Bergin, Patrick	Napanee	Limestone.
Bolender Bros.	Haliburton	Crystalline Limestone.
Bourgie, J. B.	Russell tp.	Limestone.
Britnell & Co., Ltd.	Somerville	Limestone.
Britnell & Co., Ltd.	Toronto	Limestone.
Brown, A. C.	Leeds tp.	Granite.
Brown, Robert	Lyndhurst	Granite.
Bruce Mines Trap Rock Co., Limited	Bruce Mines	Trap.
Brunner, Mond Canada, Ltd.	Amherstburg	Limestone.
Canada Crushed Stone Corporation, Limited	Dundas	Limestone.
Cayuga Stone Co.	N. Cayuga tp.	Limestone.
Contractors' Supply Co., Limited	Toronto	Crushed Limestone.
Cook, J. S. & Son	Warton	Limestone.
Crookston Quarries, Ltd.	Crookston	Limestone.
Crushed Stone, Limited	Kirkfield	Crushed Limestone.
Department of Highways		Limestone.
Farr, Mrs. L. G.	Haileybury	Limestone.
Fort William, Corp'n. of the City of	Indian Reserve	Trap.
Granite Crushed & Dimension, Ltd.	Toronto	Granite.
Gallagher Lime & Stone Co.	Hamilton	Limestone.
Gordon Granite Co., D. J.	Gananoque	Granite Bloeks, etc.
Hagersville Contracting Co.	Dundas	Limestone.
Hagersville Crushed Stone Co., Limited	Hagersville	Limestone.
Hagersville Quarries	Walpole tp.	Limestone.
Haldimand County Good Roads System	Nelles Cor. & Dunnville	Limestone
Hamilton, Corporation of	Hamilton	Limestone.
Higginson, Geo. & Son	Coldwater	Limestone.
Horne, Wm.	Ignace and Butler	Granite.
Hydro-Electric Power Commission	Queenston	Limestone.
Jamieson Lime Co.	Renfrew	Limestone.
Kingston Penitentiary Quarries	Portsmouth	Limestone.
Lincoln County	N. Grimsby tp.	Limestone.
Longford Quarry Co., Limited	Longford Mills	Limestone and Riprap.
Markus, Wm. Ltd.	Pembroke	Limestone.
Michigan Central Railway Co.	Hagersville	Limestone.
Middleton, John N.	Ancaster	Limestone.
Mond Nickel Co., Ltd.		Trap.
Oliver-Rogers Stone Co., Limited, The	Owen Sound	Trap.
Ontario Rock Co., Ltd.	Toronto	Trap.
Ontario Stone Corporation, Limited	Uthoff	Limestone.
Perkins, Geo. A.	Owen Sound	Limestone.
Point Anne Quarries, Limited	Point Anne	Limestone.
Prescott, Corporation of	Prescott	Limestone.
Queenston Quarry Co., Limited	St. David	Limestone.
Quinlan & Robertson, Ltd.	Crookston	Limestone.
Robillard, H.	Gloucester tp.	Limestone.
Reid, C. F.	Odessa	Limestone.
Rideau Canal Supply Co., Limited	Ottawa	Limestone.
Robertson, D., Co.	Nassagaweya	Sandstone.
Robertson, D., & Company, Limited	Milton	Sandstone.
Robillard, H., & Son	Ottawa	Limestone.
Roddy & Monk	Kingston	Limestone.
Rogers & Co., F.	Toronto	Sandstone.
Standard White Lime Co., Limited	Beachville, Guelph and St. Marys	Limestone.
Street & O'Brien	Gananoque	Granite.
Thames Quarry Co.	St. Marys	Limestone.
Walker Bros.	Thorold	Limestone.
Wentworth Quarry Co., Limited	Vinemount	Limestone.
Whitney, Geo., & C. W.	Terra Cotta	Sandstone.
Wilson, Geo. S.	Perth, R.R. No. 3	Sandstone.

The tonnages of limestone and trap marketed were 2,859,245 and 81,262 respectively. Details for a five-year period are given in the following table:

TABLE XV.—VALUE OF STONE PRODUCTION, 1916-1920.

Year	Limestone	Sandston	Trap	Granite	Marble	Total
	\$	\$	\$	\$	\$	\$
1916.....	625,628	14,268	91,762	23,655	.....	755,313
1917.....	728,975	115,932	70,570	25,575	.....	941,052
1918.....	820,985	145	24,744	23,334	.....	869,238
1919.....	1,112,340	5,544	82,995	19,683	19,369	1,230,922
1920.....	3,786,263	10,592	92,630	55,277	300	3,944,972

Mining Divisions

The mineral areas of the Province are comprised in twelve Mining Divisions. The official in charge of a Mining Division is termed a Mining Recorder, and he administers the Crown lands within his Division for the purposes of the Mining Act. He issues miners' licenses, receives and records applications for mining claims, settles disputes between licensees, and performs a variety of other duties laid down for him in the Act. There is an appeal from his decisions to the Mining Commissioner, who is clothed with judicial powers with respect to mining lands. Once the Crown title has issued, any subsequent controversy is referred to the ordinary courts of law. This decentralized system has proven of much advantage, being local in administration, flexible in operation, and enabling speedy and inexpensive settlement to be made of disputes concerning mining lands, which are bound to arise under any conceivable mining law.

At the end of the year the Recorders report to the Department regarding the work of their respective offices, and comment upon the state of the mining industry in their Divisions. Although there are thirteen Mining Divisions, there are only nine Mining Recorders, a single Recorder being in three cases in charge of two Divisions, where the amount of business or local convenience indicates the advisability of such an arrangement. Where mining claims are staked in those parts of the Province not included in a Mining Division, the Department of Mines at Toronto acts as Recorder, also in one Division for which there is no resident Recorder. During 1920, at Toronto, 307 miners' licenses and 167 renewals were issued.

Following is a summary of the reports of the Mining Recorders:—

Sudbury.—About the first of the year there was considerable activity in West Shiningtree, owing principally to the fact that some of the companies were doing development work. Some staking was done for gold in the township of Marshay, and the holders of these claims are going ahead with the assessment work.

Porcupine.—There have not been many new discoveries or developments in this camp during the past year, which was a poor year for prospecting on account of the high cost of labor and materials and the state of the financial market. The output of the producing mines in the camp last year was the largest in its history, and 1921 promises to be a banner year. Labor conditions have so improved that the mines will be able to produce to capacity for the first time in several years, and there is a noticeable reduction in the cost of material and supplies. It is anticipated that, as a result, prospecting will be considerably stimulated.

Sault Ste. Marie.—Business improved, mainly through the activity of the prospectors along the line of the Algoma Central railway. About 180 claims were staked and recorded in the Goudreau section, some of which have been patented. The O'Brien interests of Cobalt have secured an option on the McCarthy-Webb gold claims in that camp.

Port Arthur.—Interest centred in the nickel deposits near the western extremity of Lower Lake Shebandowan, and the area near Schreiber where gold has been found on the Longworth property, about two and a half miles south of the town, and also on W. S. Jackson's claim about two miles east of Schreiber. The reduced charge for filing claims materially lessened the receipts.

Kowkash.—The year 1920 has not shown much activity in the Kowkash Division.

Parry Sound.—This office was closed on November 1st, 1920, and all records of the Division were transferred to the Department at Toronto.

Gowganda.—Over 200 mining claims were recorded and considerable development work was performed on these new claims. Several rich discoveries of silver were reported during the summer.

Montreal River.—Forest fires in this Division during the most opportune time for prospectors to visit their claims, greatly hindered both prospecting and development. Matachewan no doubt will be attractive to the prospector as soon as mining operations commence on the Otisse and Davidson claims.

The two tables following show the work done in the offices of the Mining Recorders during 1920, the first table being for the fiscal year ending October 31, and the second for the calendar year.

MONEYS REMITTED BY MINING RECORDERS FOR THE FISCAL YEAR ENDING OCTOBER 31, 1920

Mining Division	Name of Recorder	Address	Purchase Price	Permits	Miners' Licenses	Recording fees, etc.	Total
			\$ c.	\$ c.	\$ c.	\$ c.	\$ c.
Sudbury.....	Campbell, C. A.....	Sudbury.....	3,580 66	470 00	2,936 00	3,272 00	10,258 66
Porcupine.....	Donaghue, W. A.....	S. Porcupine.....	5,664 17	91 00	1,676 00	1,950 25	9,381 42
Larder Lake.....	Ginn, H. G.....	Swastika.....	19,010 91		1,998 00	9,648 60	30,657 51
Sault Ste. Marie.....	Miller, W. N.....	Sault Ste. Marie.....	1,526 98	50 00	1,124 00	774 50	3,475 48
Port Arthur.....	Morgan, J. W.....	Port Arthur.....	2,791 10	30 00	1,806 00	1,456 00	6,083 10
Kowkash.....	McAnlay, N. J.....	Haileybury.....	1,668 58	150 00	5,630 00	3,217 75	10,666 33
Timiskaming.....	McQuire, H. F.....	Parry Sound.....	300 00		679 00	503 00	1,482 00
Gowganda.....	Morgan, M. R.....	Elk Lake.....	1,739 90	590 00	1,216 25	4,308 00	7,854 15
Montreal River.....	O'Flaherty, T. F.....	Kenora.....	1,109 30		324 00	280 65	1,713 95
Kenora.....							
Total.....			37,391 60	1,381 00	17,389 25	25,410 75	81,572 60

25410.75
47800.60
57,097.60

SUMMARY OF BUSINESS IN THE SEVERAL MINING DIVISIONS FOR THE CALENDAR YEAR, 1920.

	Sudbury	Porcupine	Larder Lake	S. Marie	Pt. Arthur	Kowkash	Timiskaming & Coleman	Parry Sound	Gowganda	Montreal River	Kenora	Total
1. Letters received.....	1,664	1,859	5,100	615	2,308	488	1,592		1,267	2,447	1,115	18,455
2. Letters written.....	1,328	1,817	4,680	381	2,197	413	1,134		1,055	2,029	1,152	16,186
3. Miners' Licenses issued.....	246	120	131	113	111	5	280	46	28	40	34	1,154
4. Miners' Licenses renewed.....	364	238	205	121	229	26	869	71	49	124	30	2,416
5. Mining applications recorded.....	267	192	712	90	108	21	329	33	215	81	25	2,073
6. Mining applications cancelled.....	465	330	385	45	241	22	387	13	108	169	38	2,203
7. Agreements, Transfers, etc., recorded.....	180	102	509	29	27	9	161	5	74	83	6	1,245
8. Amount received for Miners' Licenses, Permits, Recording Fees, etc.....	\$6,503 55	\$3,777 00	\$10,912 55	\$1,930 50	\$2,927 25	\$418 75	\$8,599 50	\$828 00	\$2,856 00	\$2,401 50	\$302 50	\$41,457 10
9. Amount received as Purchase Money or Rental	\$2,357 47	\$6,539 84	\$20,410 41	\$2,193 72	\$2,932 95	\$179 55	\$1,102 94	\$300 00	\$854 77	\$1,028 48	\$491 05	\$38,391 18
10. Claims of which surveyors' plans were filed	49	33	303	56	43	4	13		24	10	1	536
11. Disputes entered.....		1	11	1			2					15
12. Disputed cases decided by Recorder.....			6									6
13. Appeals to Mining Commissioner.....		1					3				4	8
14. Extensions of time.....	124	98	492	2	89	24	37	15	94	103	7	1,085
15. Certificates of Record	39	71	280	13	18	7	18	6	24	18	1	525
16. Certificates of Performance of Work.....	41	69	325	21	43	5	16	3	25	16	6	570
17. Claims for which papers were forwarded to the Department for issue of title.....	36	64	203	22	46	4	18	2	22	14	5	436
18. Forest Reserve Permits issued.....	49			6	5	1	15		9	44		129
19. Substitute Miners' Licenses issued.....			2	1			13	2		1		19

Mining companies incorporated under the Ontario Companies Act in 1920 are shown in the list appended, together with their respective head offices, date of incorporation and amount of capital authorized.

MINING COMPANIES INCORPORATED IN 1920

Name of Company	Head Office	Date of Incorporation	Capital \$
Ajax Oil and Gas Company, Limited	Toronto	April 22	500,000
Algomont Mines, Limited	Toronto	Mar. 12	4,000,000
Alkyris Mines, Limited	Goderich	June 25	1,000,000
Allied Oil, Limited	Toronto	Jan. 17	250,000
Alliston Gold Mines, Limited	Alliston	Sept. 11	1,000,000
Alpine Silver Mines, Limited	Niagara Falls	Sept. 20	2,000,000
Bailey Silver Mines, Limited	Toronto	Feb. 3	1,250,000
Barry-Webster Gold Mines, Limited	Haileybury	July 29	2,000,000
Beaver Nickel Company, Limited	Fort William	July 10	300,000
Biemark Oil Company, Limited	Toronto	Jan. 30	1,000,000
Big Win Oil and Gas Company, Limited	Toronto	Dec. 23	500,000
Border Cities Oil and Gas Company, Limited	Windsor	May 6	100,000
Bousquet Gold Mines, Limited	Toronto	Nov. 1	2,000,000
Brantford Sand and Gravel Company, Limited	Brantford	July 5	100,000
Bridgen Brick and Tile Company, Limited	Brigden	April 6	40,000
British Tale and Mineral, Limited	Toronto	Oct. 15	200,000
Canadian Associated Goldfields, Limited	Toronto	Aug. 7	30,000,000
Canadian Casey Cobalt Company, Limited	Toronto	Sept. 2	245,000
Canadian Clay Company, Limited	Toronto	May 20	500,000
Cardiff Molybdenite Mines, Limited	Toronto	Jan. 16	40,000
Challenger Gold Mining Company, Limited	Toronto	Aug. 27	110,000
Clover Gas and Oil Company, Limited	Fort Erie	Dec. 10	100,000
Concrete Brick Company of Canada, Limited	Windsor	April 1	40,000
Conroy-McAndrew Silver Mining Co., Limited	Toronto	Feb. 18	100,000
Deloro Chemical Company, Limited	Deloro	Sept. 27	500,000
Diamond Oil, Limited	Glencoe	Nov. 29	1,000,000
Don Valley Brick Works, Limited	Toronto	Sept. 20	1,000,000
Eagle Oil and Gas Company, Limited	Toronto	Aug. 9	500,000
Erie Clay Products, Limited	Port Dover	Dec. 8	80,000
Essex Brick Works, Limited	Essex	May 31	25,000
Eureka Oil and Gas Company, Limited	Toronto	Mar. 19	500,000
Federal Feldspar, Limited	Toronto	Mar. 5	40,000
Franc Porcupine Mines, Limited	Toronto	Jan. 15	1,500,000
Gibson Gold Mines, Limited	Toronto	Feb. 6	1,000,000
Graphite Oils, Limited	Toronto	Jan. 10	500,000
Great Kirkland Gold Mines, Limited	Toronto	Nov. 12	1,500,000
Hagersville Quarries, Limited	St. Thomas	Nov. 22	100,000
Harvey-Kirkland Gold Mines, Limited	Toronto	May 1	1,500,000
Height of Land Mining Syndicate, Limited	Toronto	July 23	50,000
Highland-Kirkland Mines, Limited	New Liskeard	Oct. 25	100,000
Indian Peninsula Molybdenum Co., Limited	Toronto	Nov. 15	1,000,000
Iroquois-Kirkland Mines Corporation, Limited	Toronto	July 2	2,000,000
King Kirkland Gold Mines, Limited	Toronto	Mar. 2	2,500,000
Kitchener Kirkland Mines, Limited	Kitchener	Mar. 4	3,000,000
Kitchener Oil Company, Limited	Kitchener	Oct. 30	40,000
Kyto Oil and Gas Company, Limited	Windsor	July 2	99,000
Lafayette Silver Mines, Limited	Toronto	April 20	750,000
Lebel Crystal Lake Gold Mines, Limited	Kirkland Lake	Jan. 5	3,000,000
Lebel Oro Mines, Limited	Toronto	April 21	1,500,000
Lightning River Gold Mines, Limited	Cobalt	Feb. 17	3,000,000
Mackenzie River Oil, Limited	Toronto	Nov. 12	5,000,000
Manitoulin Oil Company, Limited	Toronto	Oct. 1	1,000,000
Miller Lake Silver Star Mines, Limited	Gowganda	Mar. 20	2,000,000
Moffat-Hall Gold Mines, Limited	Haileybury	Feb. 23	3,000,000
Murray Townsite Mines, Limited	Sudbury	July 3	120,000
Muskoka Quarries, Limited	Toronto	April 27	300,000
New Harris Mines, Limited	Toronto	April 7	40,000
Niagara Sand Company, Limited	Toronto	June 11	250,000
North American Feldspar, Limited	Toronto	Sept. 7	60,000
Northern Porcupine Mines, Limited	Toronto	April 8	3,000,000
Northern Customs Mines, Limited	Toronto	Jan. 23	1,000,000
Northern Extension Cobalt Mines, Limited	Toronto	May 11	100,000
Northland Gold Mines, Limited	Haileybury	Jan. 31	2,000,000

MINING COMPANIES INCORPORATED IN 1920,—*Continued.*

Name of Company	Head Office	Date of Incorporation	Capital \$
Ontario Bricklaying Company, Limited.....	Toronto.....	Dec. 22	40,000
Ontario Production Company, Limited.....	Toronto.....	July 8	600,000
Ontario Smelters and Refiners, Limited.....	Chippawa.....	Jan. 5	750,000
Ontario Western Petroleum, Limited.....	Windermere.....	Dec. 6	500,000
Opcongo Mica Mines, Limited.....	Renfrew.....	Jan. 27	500,000
Orser-Kraft Feldspar, Limited.....	Perth.....	May 7	100,000
Penly-Cobalt Exploration Company, Limited.....	Toronto.....	July 16	50,000
Penn-Canada Fire Brick Company, Limited.....	Toronto.....	Oct. 23	40,000
Peoples' Oil and Gas, Limited.....	Chatham.....	Sept. 29	1,000,000
Pinelle Kirkland Mines, Limited.....	Toronto.....	Feb. 26	4,000,000
Primo Silver-Cobalt Mining Company, Limited.....	Toronto.....	Nov. 18	1,000,000
Progressive Gold Mines, Limited.....	Toronto.....	July 6	2,000,000
Ruby Operative Cobalt Mines, Limited.....	Cobalt.....	Dec. 10	1,500,000
Sarnia Cement Products, Limited.....	Point Edward.....	Oct. 25	100,000
Sesekinika Divide Mines, Limited.....	Toronto.....	Dec. 14	3,000,000
Silbar Cobalt Mines, Limited.....	Toronto.....	Mar. 6	1,500,000
Silverado Extension, Limited.....	Toronto.....	Feb. 3	1,500,000
South West Porcupine Syndicate, Limited.....	Toronto.....	July 30	100,000
Superior Oil Company, Limited.....	Toronto.....	July 6	100,000
Tar Island Oil and Gas Company, Limited.....	Toronto.....	April 19	1,500,000
Thames Oil and Gas Company, Limited.....	Toronto.....	June 25	500,000
The Blue Mountain Oil and Gas Co., Limited.....	Toronto.....	Aug. 25	40,000
The Brant-Keora Mining Company, Limited.....	Toronto.....	July 28	2,000,000
The Casey Mountain Operating Syndicate, Ltd.....	Toronto.....	Dec. 6	100,000
The Central Canada Oil Company, Limited.....	Toronto.....	Feb. 12	500,000
The Doran Oil and Gas Company, Limited.....	Meaford.....	Sept. 2	100,000
The Herman Exploration and Development Company, Limited.....	South Porcupine.....	Feb. 19	25,000
The Independent Oil Company of Adelaide, Ltd.....	Adelaide.....	April 6	40,000
The International Prospecting and Developing Company, Limited.....	Ottawa.....	Mar. 10	1,000,000
The Kingston Smelting and Refining Company, Limited.....	Kingston.....	June 2	1,000,000
The Ontario and Peace River Oil and Gas Producing Company, Limited.....	Toronto.....	May 6	2,500,000
The Ontario Cement Company, Limited.....	Brantford.....	Feb. 19	1,000,000
The Petrol Oil and Gas Company, Limited.....	Toronto.....	May 12	1,000,000
The Regent Mines, Limited.....	Sarnia.....	July 2	1,000,000
The Sarnia Oil and Gas Company, Limited.....	Sarnia.....	Nov. 11	500,000
Thesaurus Gold Mines, Limited.....	Toronto.....	Jan. 6	1,000,000
The Silica Granite Products Company, Limited.....	Hamilton.....	Oct. 8	200,000
The Springvale Gas and Oil Company, Limited.....	Hagersville.....	Dec. 10	100,000
The Trinidad Oil Producing and Refining Company (of Canada), Limited.....	Toronto.....	April 29	150,000
The Victory Oil and Gas Company, Limited.....	Toronto.....	June 21	500,000
The Western Oil Company, Limited.....	St. Catharines.....	Dec. 8	500,000
The West Williams Oil and Gas Co., Limited.....	Parkhill.....	Aug. 27	40,000
Toronto-Great Lakes Oils, Limited.....	Toronto.....	Jan. 9	200,000
Toronto Oil Company, Limited.....	Toronto.....	Nov. 12	1,000,000
Trans-Canada Explorers, Limited.....	Toronto.....	May 6	200,000
Trans-Canadian Oil Company, Limited.....	Aylmer.....	April 6	5,000,000
Turnbull Mines of Porcupine, Limited.....	Toronto.....	Dec. 18	2,000,000
Union Exploration Company, Limited.....	Chatham.....	Oct. 1	1,000,000
Union Mining Corporation, Limited.....	Toronto.....	Feb. 13	1,000,000
Universal Gas and Oil, Limited.....	Toronto.....	Aug. 12	1,500,000
Valley Oil and Gas Company, Limited.....	Hamilton.....	Sept. 13	100,000
Victory Silver Mines, Limited.....	St. Catharines.....	May 20	2,000,000
Wasapika Consolidated Mines, Limited.....	Toronto.....	Jan. 16	6,000,000
Western Counties Gas Company, Limited.....	Toronto.....	Mar. 5	250,000
Whitney-Porcupine Gold Mines, Limited.....	Haileybury.....	June 21	40,000
York Brick and Building Company, Limited.....	Toronto.....	May 29	100,000
Total (119 Companies).....			146,091,000

Companies of Extra-Provincial incorporation holding mining lands in Ontario are required under The Ontario Companies Act to take out a license and specify the amount of capital used in Ontario in connection with mining.

Following is a list of the companies so licensed in 1920:

MINING COMPANIES LICENSED IN 1920.

Name of Company	Head Office for Ontario	Date of License	Capital for use in Ontario
			\$
Argonaut Gold, Limited.....	Dane.....	Dec. 6	1,000,000
Brunner Mond Canada, Limited.....	Toronto.....	Nov. 23	5,000,000
Chippewa Petroleum Corporation.....	Hamilton.....	Mar. 23	40,000
Coke Oven Company of Canada, Limited.....	Hamilton.....	May 4	5,000
Inter-Provincial Brick Company of Canada, Limited.....	Toronto.....	Nov. 4	500,000
Keeley Silver Mines, Limited.....	Almonte.....	July 27	600,000
Kirkland Lake Proprietary (1919), Limited.....	Toronto.....	Mar. 27	1,350,000
Super-Cement (America) Company, Limited.....	Toronto.....	Feb. 19	100,000
The Cassel Cyanide Company of Canada, Limited.....	Montreal.....	Aug. 3	50,000
Tide Water Oil Sales Corporation.....	Toronto.....	Aug. 27	40,000
Vermont Marble Company.....	Peterborough.....	May 1	150,000
Windsor Petroleum and Refining Company, Limited.....	Windsor.....	June 10	600,000
Total (12 Companies).....			9,435,000

Companies which surrendered their charters were as follows:—

MINING COMPANY CHARTERS SURRENDERED IN 1920

Name of Company	Date of Dissolution
Elora White Lime Company, Limited.....	Nov. 13
Harris Consolidated Mines, Limited.....	Oct. 4
Keeley Mine, Limited.....	Nov. 15
Ontario Cement, Limited.....	May 10
St. Marys Cement, Limited.....	Feb. 2
The North Thompson Gold Mines, Limited.....	Dec. 20
Toronto Cement Products Company, Limited.....	Feb. 16

The following companies were authorized to increase their capital stock:—

INCREASE OF CAPITAL STOCK

Name of Company	Date	Increase of Capital Stock
		\$ \$
Goldsmith Brothers, Smelting and Refining Company, Limited.....	Oct. 20	40,000 to 200,000
Hunton-Kirkland Gold Mines, Limited.....	Nov. 10	1,500,000 to 2,500,000
Premier Langmuir Mines, Limited.....	July 19	2,000,000 to 2,800,000
The Cobalt-Frontenac Mining Company, Limited....	Aug. 4	2,000,000 to 3,000,000

Mining Revenue

The revenue for the fiscal year ending October 31st, 1920, amounted to \$1,117,499.55, the particulars being as follows:—

Sales of mining land.....		\$39,095 28
Mining leases.....		22,411 64
Fuel investigation.....		84,246 97
Sand and gravel royalties.....		99,324 89
Sand and gravel rentals.....		3,576 68
Miners' licenses, etc.....		59,097 60
Mining Tax Act,—		
Acreage tax.....	71,223 26	
Profit tax.....	713,291 46	
Gas tax.....	22,525 80	
		<u>47,800.00</u>
		<u>16,297.60</u>
		807,040 52
Natural Gas Act, 1919.....		1,660 00
Provincial Assay Office fees.....		633 50
Miscellaneous.....		412 47
Total.....		<u>1,117,499 55</u>

MINING LANDS SOLD AND LEASED IN FISCAL YEAR ENDING OCTOBER 31st
1920

District	Sales			Leases			Total		
	No.	Acres	Amount	No.	Acres	Amount	No.	Acres	Amount
			\$ c.			\$ c.			\$ c.
Timiskaming.....	314	11,342 01	29,258 34	104	5,159 56	1,567 43	418	16,501 57	30,825 77
Thunder Bay.....	29	1,045 80	2,484 50				29	1,045 80	2,484 50
Sudbury.....	18	755 61	2,270 25	10	449 00	449 00	28	1,204 61	2,719 25
Algoma.....	14	565 84	1,466 58				14	565 84	1,466 58
Kenora.....	12	474 97	1,227 05				12	474 97	1,227 05
Rainy River.....	8	921 31	2,209 88				8	921 31	2,209 88
Nipissing.....	1	50 00	150 00	2	69 10	28 23	3	119 10	178 23
Elsewhere.....	5	250 00	750 00				5	250 00	750 00
Total.....	401	15,405 54	39,816 60	116	5,677 66	2,044 66	517	21,083 20	41,861 26

A large quantity of sand and gravel is annually recovered by dredging in the great lakes and connecting rivers, under licenses from the Mines Department. Varying rates of royalty per cubic yard are collected. As shown above the revenue from this source for 1920 including license fees, was \$102,901.57.

Under the Mining Tax Act, a graduated tax is levied on the profits of mining companies in excess of \$10,000 per annum. The basal rate is 3 per cent., but there are special provisions for nickel-copper companies. The following statement gives details of the Profit tax for the last fiscal year.

DETAILS OF PROFIT TAX

GOLD:

Dome Mines Company, Ltd.	\$ 2,470 66
Hollinger Consolidated Gold Mines, Ltd.,	66,927 26
Lake Shore Mines, Ltd.	3,392 67
McIntyre Porcupine Mines, Ltd.	5,803 05
	<u>\$ 78,593 64</u>

SILVER:

Bailey Silver Mines, Ltd.	\$ 284 94	
Beaver Consolidated Mines, Ltd.	772 52	
Casey Kismet Mining Company, Ltd.	28 17	
Coniagas Mines, Ltd.	8,203 19	
Crown Reserve Mining Company, Ltd.	1,186 19	
Harris Consolidated Mines, Ltd.	345 26	
Kerr Lake Mining Company, Ltd.	13,739 74	
McKinley-Darragh-Savage Mines of Cobalt, Ltd.	3,244 09	
M. J. O'Brien, Ltd. (Miller-Lake O'Brien)	11,953 00	
Mining Corporation of Canada, Ltd.	3,769 86	
Nipissing Mining Company, Ltd.	82,297 43	
Trethewey Silver Cobalt Mine, Ltd.	779 49	
		\$126,603 88

NICKEL-COPPER:

International Nickel Co., of Canada, Ltd.		
Tax arrears (1918 and 1919)	\$371,275 16	
Tax (1920)	132,793 56	
		\$504,068 72
Mond Nickel Company, Ltd.	3,841 38	\$507,910 10

MISCELLANEOUS:

Canadian Sulphur Ore Company, Ltd. (Iron pyrites)	\$ 95 08	
Black Donald Graphite Company, Ltd. (Graphite)	88 76	
		\$ 183 84
Total		\$713,291 46

Provincial Assay Office

The Provincial Assayer, W. K. McNeill, reports as follows for the year 1920:

The Assay Office has been in operation without interruption during the entire year, and the usual variety of work has been done with the assistance of T. E. Rothwell, Chemist and Assayer, and Robert Stewart, Laboratory Assistant.

The work during the year may be classified as follows:

Gold, Silver and Platinum.—732 samples. A number of these were from Manitoba and the Maritime Provinces.

Cobalt and Nickel.—27 samples were tested and reports issued.

Copper.—62 samples. These samples were from widely distributed sources, but the majority from Ontario.

Feldspar.—2 samples were submitted for a complete analysis.

Iron Ores.—34 samples were tested for their iron content, and a number of them were analyzed also for sulphur and phosphorus.

Potash.—9 samples. These were mainly feldspars; six were also analysed for soda.

Rock Analyses.—19 specimens. Nineteen complete rock analyses were made. These samples were submitted by the geologists of the Department of Mines.

Radium.—A large number of samples were tested coming mainly from Butt township and Parry Sound district. A number were radio-active. A much larger number were brought to the Laboratory directly, and if not radio-active no records were kept.

Miscellaneous.—Seventy-one samples of other minerals were tested. These included lead, zinc, barite, molybdenite, vanadium, etc. Also a large number of samples of water were tested for oil.

Following is a statement of samples assayed free under the provisions of the Mining Act of Ontario. The first sample was received June 20th, 1920.

Mining Division	Samples received for free assay
Kenora.....	6 samples for gold.
Larder Lake.....	12 samples for gold, 4 for silver.
Montreal River.....	8 samples for gold.
Poreupine.....	7 samples for gold, 1 for silver.
Port Arthur.....	2 samples for gold.
Sudbury.....	15 for gold, 1 for silver, 1 for copper, 1 for iron.
Sault Ste. Marie.....	5 for gold, 1 for silver.
Timiskaming.....	9 for gold, 6 for silver, 1 for tin, 1 for sulphur.

The schedule of charges for work at the Provincial Assay Office and Chemical Laboratory is as follows:—

TARIFF OF FEES FOR ANALYSES AND ASSAYS.

1. Assays:

Gold	\$1 50
Silver	1 50
Gold and Silver in one sample	2 50
Platinum Minerals	5 00
Gold and Platinum minerals in one sample	7 00
Separation of Platinum Minerals	Prices on application.

2. Iron Ores:

Iron (metallic)	\$1 50
Silica	1 50
Iron and insoluble residue	2 50
Ferrous Oxide	2 00
Phosphorus	3 00
Sulphur	2 50
Iron, Sulphur, Phosphorus and insoluble	8 00
Manganese	3 00
Titanium	4 00
Complete analysis	Price on application.

3. Limestones, Dolomites, Marls, Clays, Shales:

Determination of:

Insolubles	\$1 50
Silica	1 50
Ferric Iron	3 00
Ferrous Iron	2 00
Alumina	3 00
Lime	2 00
Magnesia	2 50
Potash	5 00
Soda	5 00
Alkalies (on one sample)	6 00
Water (combined)	2 00
Moisture	1 00
Carbon Dioxide	2 00
Sulphur	2 50
Phosphorus Anhydrite	3 00

4. Examination of Clay, Shale, or Cement Rock for Cement Manufacture:

Determination of:

Silica, Iron Oxide, Alumina, Lime, Magnesia, Sulphur, and Volatile matter	Prices on application.
---	------------------------

5. Coal, Coke, Peat, etc.:

Determination of:

Moisture	\$1 00
Volatile Combustible	1 50
Fixed Carbon	1 50
Ash	1 50
Sulphur	2 50
Phosphorus	3 00
Calorific value (B.T.U.)	5 00
Ultimate analysis	Price on application.

6. *Mineral Waters*Price on application.

7. *Ores and Minerals:*

Determination of:

Alumina	\$3 00
Antimony	4 00
Arsenic	4 00
Bismuth	4 00
Cadmium	4 00
Chromium	5 00
Cobalt	5 00
Nickel	5 00
Cobalt and Nickel on same sample	6 00
Copper	2 00
Fluorite	4 00
Lead	3 00
Molybdenum	4 00
Manganese	3 00
Tin	4 00
Zinc	3 00

8. *Rocks, Complete Analysis*Price on application.

9. *Slags, Sand, etc.*Price on application.

10. *Identification of Minerals and Rocks not Requiring Chemical Analysis*..Free

11. *Test for Radio-Activity*Free.

Any analytical work not specified in this list will be undertaken on application to the Provincial Assayer.

The pulp of each sample is retained for future reference.

DIRECTIONS

Samples will be dealt with in the order of their arrival. In every instance specimens and samples should be accompanied by statement specifying the precise locality whence they were taken.

Crushed samples representing large quantities or samples less than five pounds weight may be sent by mail as third-class matter. The name and address of sender should be written plainly on each parcel. Instructions, with money in payment of fees, should be contained in a separate letter. Samples may be sent by express, charges prepaid.

Sample bags addressed to this Laboratory for sending ore pulp by mail may be obtained free on application; also canvas bags for shipping.

Money in payment of fees, sent in by registered letter, post-office order, postal note, or express order, and made payable to the Provincial Assayer, must invariably accompany sample to ensure prompt return of certificate, as no examination is commenced until the regulation fee is paid.

Samples should be addressed as follows:

Provincial Assay Office,

5 Queen's Park,

Toronto, Ont.

Departmental Correspondence

The volume of correspondence necessary for the work of the Department in all its branches is considerable. Figures supplied by the Files branch show that from 1st January to 31st October, 1920, communications received numbered 20,210, and communications sent out 21,125. New files issued were 585, and amount paid out for postage was \$1600.

MINING ACCIDENTS IN ONTARIO, 1920

By

Chief Inspector of Mines, T. F. Sutherland, Toronto; Inspectors, G. E. Cole, Ottawa;
James Bartlett, Sudbury; J. G. McMillan, Cobalt;
A. R. Webster, Toronto

During the year 1920 at the mines, metallurgical works, quarries, clay and gravel pits regulated by the Mining Act of Ontario, there were 26 fatal accidents, causing the death of 29 men, as compared with 39 deaths in 1919. Of these accidents, 13 occurred underground and resulted in 15 deaths. Six men were killed above ground at the mines, 3 at the metallurgical works and 5 at the quarries and clay and gravel pits.

Seventeen companies had fatal accidents during the year.

Six war veterans were among those killed.

Up to January 15, 1921, there had been reported to the Department for the year 1920, 1,497 non-fatal accidents at the mines and metallurgical works. Of these, 634 occurred underground, 372 occurred above ground at the mines, and 491 at the metallurgical works.

By months, the fatalities occurred as follows:

	1920
January.....	3
February.....	1
March.....	0
April.....	4
May.....	4
June.....	1
July.....	3
August.....	1
September.....	2
October.....	3
November.....	5
December.....	2
Total.....	29

The fatalities were divided amongst the several districts as follows:

Cobalt.....	3
Porcupine.....	7
Sudbury.....	11
Kirkland Lake.....	3
Southeastern Ontario.....	2
Southwestern Ontario.....	3
Total.....	29

Classifying the fatalities according to the industry gives the following:

Nickel mines and smelters.....	9
Iron mines.....	2
Silver mines and mills.....	3
Gold mines and mills.....	10
Limestone quarries.....	4
Gravel pits.....	1
Total.....	29

Table of Fatalities

	1916	1917	1918	1919	1920
Mines, underground.....	30	19	11	21	15
Mines, surface.....	7	7	4	6	6
Metallurgical works.....	8	6	12	10	3
Quarries.....	6	4	5	2	5
Total.....	51	36	32	39	29

Analysis of Fatalities at Mines

	1916 Per cent.	1917 Per cent.	1918 Per cent.	1919 Per cent.	1920 Per cent.
Falls of ground.....	24.3	15.4	20.0	22.2	23.8
Shaft accidents.....	27.0	15.4	0.0	29.6	9.5
Explosives.....	21.6	15.4	40.0	7.4	23.8
Miscellaneous underground.....	8.1	26.9	26.6	18.5	14.3
Surface.....	18.9	26.9	13.3	22.2	28.6

Table of Fatal Accidents in Mines, Metallurgical Works and Quarries,
1901 to 1920

Year	Persons killed at metallurgical works and mines	Persons employ- ed at metallur- gical works and producing mines	Persons employ- ed at non-pro- ducing mines (estimated)	Total persons employed	Fatal accidents per 1000 em- ployed
1901.....	13	4,135	550	4,685	2.77
1902.....	10	4,426	450	4,876	2.05
1903.....	7	3,499	400	3,899	1.79
1904.....	7	3,475	400	3,875	1.80
1905.....	9	4,415	500	4,915	1.83
1906.....	11	5,017	750	5,767	1.90
1907.....	22	6,305	1,140	7,445	2.93
1908.....	47	7,435	1,750	9,185	5.11
1909.....	49	8,505	2,000	10,505	4.66
1910.....	48	10,862	2,000	12,862	3.73
1911.....	49	12,543	2,000	14,543	3.37
1912.....	43	13,108	2,000	15,108	2.84
1913.....	64	14,293	2,000	16,293	3.93
1914.....	58	14,361	1,500	15,861	3.60
1915.....	22	13,114	1,500	14,614	1.51
1916.....	51	14,624	2,000	16,624	3.07
1917.....	36	16,791	1,000	17,791	2.02
1918.....	32	14,726	500	15,226	2.10
1919.....	39	11,926	1,000	12,926	3.00
1920.....	29	10,486	1,000	11,486	2.61

The occupation and nationality of the men killed are set out in the following table:

	English speaking	Austrian	Italian	Bulgarian	Belgian	Polish	Dutch	Norwegian	Spanish	Total
Labourer.....	5							1		6
Miner.....	3				1	1				5
Blaster.....	1	1		2			1			5
Millman.....	1		1							2
Hoistman.....	1	1								2
Brakeman.....	1	1			1					2
Meehanic.....			1		1					2
Cagetender....	1									1
Scaler.....									1	1
Chuteman.....	1									1
Timberman.....			1							1
Manager.....	1									1
Totals.....	15	3	3	2	2	1	1	1	1	29

The ages of the men killed were as follows:

Age	17-20	21-25	26-30	31-35	36-40	41-45	51-55	Total
No. killed.....	3	7	7	2	6	3	1	29

The cause and place of fatalities in mines are noted below:

BELOW GROUND:

Falls of ground.....	4
Premature explosion.....	4
Remained too long lighting.....	1
Cage accidents.....	1
Struck by skip.....	1
Rock falling from bench.....	1
Buried in stope.....	1
Falling from bench.....	1
Crushed by car.....	1

ABOVE GROUND:

Crushed by machinery.....	4
Falls.....	2
Transportation.....	2
Failure of derrick.....	2
Thawing explosive.....	1
Caught by blast.....	1
Caught in belt.....	1
Struck by log.....	1

Non-Fatal Accidents

The occupation and nationality of the men injured at the mines are shown in the following table:

Mines—Surface and Underground	English speaking	Italian	Austrian	Russian	Finnish	Polish	Bulgarian	Romanian	Spanish	French	Serbian	Swede	Galician	Belgian	Greek	German	Dutch	Unknown	Total
Miner.....	190	60	65	39	28	34	13	7	5	3	1	2	2	1	1	2	1	3	308
Labourer.....	76	18	4	6	2	3	1	1	2	1	1	1	1	1	1	1	1	1	117
Trammer.....	46	8	27	8	1	4	3	3	2	1	1	1	1	1	1	1	1	1	103
Millman.....	40	7	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	50
Mechanic.....	29	10	2	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	45
Timberman.....	15	3	1	1	13	1	1	1	1	1	1	1	1	1	1	1	1	1	34
Carpenter.....	21	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	25
Foreman.....	15	5	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	23
Chute blaster.....	5	1	7	3	1	3	1	1	1	2	1	1	1	1	1	1	1	1	23
Electrician.....	10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	12
Motorman.....	8	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	12
Blacksmith.....	10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	12
Deckman.....	6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	10
Teamster.....	10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	10
Scaler.....	4	2	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	10
Chute loader.....	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	6
Fireman.....	5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	5
Crusher.....	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	5
Bushman.....	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	5
Trackman.....	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	5
Blaster.....	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	5
Carpenter helper.....	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4
Shaftman.....	1	1	1	1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	4
Nipper.....	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4
Engineer.....	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4
Assayer.....	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4
Cage tender.....	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3
Cook.....	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2
Furnace operator.....	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2
Moulder.....	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Bricklayer.....	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Storeman.....	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Trainman.....	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Painter.....	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	527	125	112	65	53	48	24	12	9	6	5	4	3	2	2	2	2	5	1,006

The causes of the non-fatal accidents at mines are shown in the following table:

Cause of Accident	Surface	Under-ground	Total
Struck by rock when loading cars at chute.....		138	138
Handling rock or sealing.....	4	97	101
Fall of ground.....		76	76
Crushed or hit by ore car.....	12	60	72
Slipped, or tripped and fell.....	42	16	58
Sprain.....	25	24	49
Struck by falling objects.....	30	16	46
Crushed between two objects.....	22	17	39
Cut by metal, scrap, etc.....	14	18	32
Foreign matter in eye.....	15	16	31
Fell from elevation.....	15	13	28
Caught by machinery.....	26		26
Injured by tools.....	25	1	26
Struck by flying objects.....	10	11	21
Struck by falling drill.....		19	19
Injured by bar.....	8	11	19
Infection from cut.....	14	4	18
Fall.....	8	10	18
Burned.....	11	6	17
Stepped on nail.....	16		16
Injured by timber.....	7	9	16
Caught by drill.....	2	12	14
Hit by hammer.....	4	7	11
Injured by drill steel.....		11	11
Collapse of staging.....	3	7	10
Injured by cage or skip.....	3	6	9
Injured by particles dislodged by drill-bit.....		9	9
Hit by machinery.....	7	2	9
Caught by belt.....	8		8
Electric burns.....	7		7
Falling material in shafts.....		7	7
Rock knocked off cars by chute.....		6	6
Struck head against object.....	2	2	4
Falling off ladder in shaft.....		3	3
Poisoning.....	3		3
Caught in shafting.....	3		3
Miscellaneous.....	26		26
Total.....	372	634	1,006

The occupation and nationality of the men injured at metallurgical works are set out in the following table:

Occupation	English speaking	Italian	Austrian	Chinese	Russian	French	Polish	Finnish	Synan	Roumanian	Macedonian	Serbian	Galician	Bulgarian	Total
Labourer.....	91	60	26	19	12	4	3	5	5	1	1	2	1	...	230
Furnace man.....	22	7	5	...	1	3	3	...	...	2	1	...	...	1	45
Mechanic.....	27	1	1	...	...	...	...	...	...	...	...	...	...	...	29
Furnace helper.....	5	5	5	1	4	...	1	...	...	...	...	...	...	...	21
Trainman.....	17	...	...	...	...	...	...	...	...	...	...	...	...	...	17
Smelterman.....	16	...	...	...	...	...	...	...	...	...	...	...	...	...	16
Foreman.....	12	4	...	...	...	...	...	...	...	...	...	...	...	...	16
Tuyere puncher.....	10	...	1	...	...	1	1	...	...	...	...	...	...	...	13
Carpenter.....	10	...	...	...	...	...	1	1	...	...	...	...	...	...	12
Blacksmith.....	7	3	...	...	...	...	...	...	...	...	...	...	...	...	10
Electrician.....	8	...	...	...	...	...	...	...	...	...	...	...	...	...	8
Cinder snapper.....	2	5	...	...	...	...	1	...	...	...	...	...	...	...	8
Scraper.....	...	3	3	...	...	...	...	...	...	...	...	...	...	...	6
Craneman.....	5	...	...	...	...	1	...	...	...	...	...	...	...	...	6
Bricklayer.....	5	...	...	...	...	...	...	...	...	...	...	...	...	...	5
Trackman.....	1	3	1	...	...	...	...	...	...	...	...	...	...	...	5
Oiler.....	4	1	...	...	...	...	...	...	...	...	...	...	...	...	5
Ladleman.....	...	1	2	...	...	...	1	...	...	...	...	...	...	...	4
Scale carman.....	2	2	...	...	...	...	...	...	...	...	...	...	...	...	4
Cokeman.....	1	3	...	...	...	...	...	...	...	...	...	...	...	...	4
Rigger.....	4	...	...	...	...	...	...	...	...	...	...	...	...	...	4
Teamster.....	3	...	...	...	...	...	...	...	...	...	...	...	...	...	3
Tramster.....	2	...	...	...	...	...	...	...	...	...	...	...	...	...	2
Gas operator.....	1	...	...	...	...	1	...	...	...	...	...	...	...	...	2
Inspector.....	1	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Stove cleaner.....	...	1	...	...	...	...	...	...	...	...	...	...	...	...	1
Motorman.....	1	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Fireman.....	...	...	...	...	...	1	...	...	...	...	...	...	...	...	1
Miscellaneous.....	10	...	1	...	1	...	...	...	...	...	...	...	...	...	12
	267	99	45	20	18	11	11	6	5	3	2	2	1	1	491

Causes of the non-fatal accidents at metallurgical works are set forth hereunder:

Hit by falling objects.....	72	Hit by machinery.....	12
Burned by slag, matte, etc.....	38	Hit by flying objects.....	10
Burned at furnace.....	35	Injured by tools.....	10
Handling rock, ore, matte.....	35	Infection from wound.....	8
Slipped or tripped and fell.....	28	Electric burn.....	7
Injured by cars.....	22	Gas asphyxiation.....	4
Crushed between two objects.....	22	Injured by train.....	4
Burned.....	18	Poisoned.....	3
Cut by metal, scrap, etc.....	16	Fell off train.....	3
Hit by hammer.....	16	Fall of ore from chute.....	2
Sprain.....	15	Fall from vehicle.....	2
Injured by crane.....	14	Fall of staging.....	2
Foreign matter in eye.....	14	Internal injury carrying load.....	2
Stepped on nail.....	13	Injured by slag pot.....	2
Caught by machinery.....	13	Cut by saw.....	1
Burned by explosion of slag or matte.....	13	Miscellaneous.....	11
Fall from elevation.....	12		
Injured by bar.....	12		
			491

Table of Fatal Accidents in or about

No.	Date	Name of Mine	Name of Owner	Name	Occupation
1	Jan. 22.	Goldfields	Associated Goldfields Mining Co., Ltd.	Peter Sorle	Lumberman
2	Nov. 27.	Bailey	Bailey Silver Mines, Ltd.	Thos. Osborne	Miner
3	Feb. 24.	Murray	British America Nickel Corporation	Fred. Doucette	Labourer
4	May 2.	do	do	F. Chemetto	Timberman
5	Oct. 7.	Dome	Dome Mines Co., Ltd.	Leon Stoffin	Miner
6	Apr. 28.	Hollinger	Hollinger Consol. Gold Mines, Ltd.	Arthur Hartog	Blaster
	Apr. 28.	do	do do	John Todor	Blaster
	Apr. 28.	do	do do	K. Vachoff	Blaster
7	June 14.	do	do do	E. Pruin	Mechanic
8	Dec. 23.	do	do do	Nicola Torlone	Millman
9	Aug. 20.	Creighton	International Nickel Co. of Canada	Antonio Gagnon	Chuteman
10	Oct. 6.	do	do do	Stanley Smith	Blaster
11	Jan. 7.	Kirkland Lake	Kirkland Lake Gold Mining Co., Ltd.	E. H. Eagling	Miner
12	May 24.	McKinley-Darragh	McKinley-Darragh-Savage Mines	John Staples	Millman
13	Jan. 12.	McIntyre	McIntyre Porcupine Mines, Ltd.	John Dolan	Miner
14	July 31.	Buffalo	Mining Corp. of Canada	Nicholas Galyk	Miner
15	Oct. 21.	Levack	Mond Nickel Co.	Francis Prefasi	Scaler
16	Nov. 12.	Levack	do	Pietro Pisani	Mechanic
17	July 7.	Moose Mountain	Moose Mountain, Ltd.	Wasył Miniw	Blaster
18	Nov. 6.	Moose Mountain	do do	Mike Kosteniak	Hoistman
19	Apr. 22.	Teek-Hughes	Teek-Hughes Gold Mines, Ltd.	James Keane	Cager

Table of Fatal Accidents at

No.	Date	Name of Mine	Name of Owner	Name	Occupation
20	May 12.	Copper Cliff Smelter	International Nickel Co. of Canada	John Dikor	Brakeman
21	July 2.	do	do do	Frederick Walker	Brakeman
22	Nov. 13.	Coniston Smelter	Mond Nickel Co.	Aldage Le Clair	Labourer

Table of Fatal Accidents at

No.	Date	Name of Mine	Name of Owner	Name	Occupation
23	Nov. 1.	Quarry	Britnell & Co., Ltd.	Robt. Wilson	Stat. Engineer
24	Dec. 29.	Gravel Pit	Howe's Farm	Lawrence Brouse	Labourer
25	Sept. 1.	Quarry	F. Rogers & Co.	Alexander Henry	Labourer
	Sept. 1.	do	do	Albert Maynard	Labourer
26	May 28.	do	Thames Quarry Co., Ltd.	John Bonis	Manager

the Mines of Ontario during 1920.

Nationality	Age	Married or single	Above ground	Below ground	Cause of Accident
Norwegian	39	S	1		Struck by log on skidway.
English	34	M		1	Buried by falling into raise with ore.
French-Canadian	38	M	1		Crushed between conveyor belt and pan feeder in rockhouse.
Italian	29	S		1	Run over by skip in shaft.
Belgian	37	S		1	Fell from bench into stope.
Dutch	39	S		1)	Explosion while loading holes.
Bulgarian	23	S		1	
Bulgarian	23	S		1	
Belgian	43	M	1		Fell from top of waste bin in crusher house.
Italian	23	S	1		Caught by belt while putting same on moving bull wheel.
French-Canadian	19	S		1	Crushed between ear and timber at ore dump.
English	29	S		1	Remained too long lighting fuses.
English	26	S		1	Fall of ground in stope.
English	42	S	1		Struck by scoop of tube mill.
Canadian	20	S		1	Fall of ground in stope.
Russian Polish	30	S		1	Fall of rock from wall of open pit.
Spanish	24	M		1	Fall of ground in stope.
Italian	24	S		1	Fall of ground in stope.
Austrian	40	M		1	Explosion occurred while loading.
Austrian	32	S	1		Crushed against briquette ear.
Irish	24	S		1	Drill steel caught in timber and threw him off cage.

Metallurgical Works, 1920.

Nationality	Age	Married or Single	Cause of Accident.
Canadian	28	S	On top of locomotive cab and fell under tram.
English	20	S	Fell off running board and under locomotive.
French-Canadian	24	S	Fell while repairing roof of shed.

Quarries, Clay and Gravel Pits, 1920.

Nationality	Age	Married or Single	Cause of Accident
Canadian	40	M	Explosion of dynamite being thawed on forge.
Canadian	27	S	Returned too soon to scene of blasting.
Canadian	45	M	Struck by boom when derrick collapsed.
Canadian	26	M	Struck by boom when derrick collapsed.
Canadian	51	M	Crushed by ear.

The occupation and nationality of the men injured through the use of explosives are set out in the following table:

Occupation	English speaking	Russian	Polish	Finnish	Austrian	Spanish	Italian	Total
Miner.....	5	1	2	.....	2	.....	1	11
Labourer.....	1	.....	.....	2	.....	1	.....	4
Blaster.....	.....	2	.....	.....	.....	.....	.....	2
Craneman.....	1	.....	.....	.....	.....	.....	.....	1
	7	3	2	2	2	1	1	18

The causes of the non-fatal explosives accidents are shown in the following table:

Premature blast.....	6	Preparing charges.....	1
Striking unexploded charge in removing debris.....	4	Not warned of shooting in drift.....	1
Drilling into unexploded charge.....	2	Light went out and walked towards blast in error.....	1
Not taking proper cover.....	1	Injury to ear by concussion.....	1
Tamping charge.....	1		
			18

Prosecutions

The Beachville White Lime Company, Limited, were fined \$100.00 and costs by Police Magistrate Alfred S. Ball, at Woodstock, on April 19, 1920, for an infringement of Rule 221, Section 164, Part IX, of the Mining Act of Ontario. The office was being used as a thawing room.

Mike Bokla, a trammer boss in the Hollinger mine, was fined \$100.00 and costs on September 3, 1920, by Police Magistrate Atkinson, at Timmins, for violating Rule 19, Section 164, Part IX, of the Mining Act of Ontario. Bokla neglected, on August 27, to guard an approach to a place in the mine where he was blasting.

Britnell and Company, Limited, were fined \$100.00 and costs by Magistrate F. D. Moore, at Lindsay, on November 25, 1920, for non-compliance with Rule 12, Section 164, Part IX, of the Mining Act of Ontario. The blacksmith forge was being used to thaw dynamite.

J. W. Simpson, manager of the Cobalt A. 53 mine, was fined \$200.00 and costs by Police Magistrate Atkinson, at Haileybury, on December 6, 1920, for an infringement of Rule 12, Section 164, Part IX, of the Mining Act of Ontario. Dynamite was being thawed in the hoist house.

The Point Anne Quarries, Limited, was fined \$100.00 and costs by Police Magistrate S. Masson, at Belleville, on December 18, 1920, for an infringement of Rule 4, Section 164, Part IX, of the Mining Act of Ontario. The company was using a magazine for explosives without a permit from the Inspector of Mines.

MINES OF ONTARIO

By

Chief Inspector of Mines, T. F. Sutherland, Toronto; Inspectors, J. G. McMillan, Cobalt; James Bartlett, Sudbury; A. R. Webster, Toronto

I.—NORTHWESTERN ONTARIO

Gold

Contact Bay Mines, Limited.—This company, mention of whose holdings was made in the Twenty-ninth Annual Report of the Ontario Department of Mines, continued to prospect the Bonanza claim near Dryden, Ontario, throughout 1920, but stopped all work on the last day of the year with the expectation of resuming in the spring. Twenty-two men were employed under the direction of Harry S. Badger, manager, and E. S. Henley, superintendent.

On a vein dipping at 75 degrees to the north a two-compartment shaft was sunk to a depth of 88 feet. A level was opened at 85 feet and drifts run 126 feet east and 90 feet west of the shaft; in the west drift at 80 feet from the shaft a raise was driven to 59 feet above the level.

J. N. Beckley, 326 Cutler Building, Rochester, N. Y., is president of the company and J. R. L. Starr, 120 Bay Street, Toronto, secretary.

Foley.—Swedish-Canadian Mines, Limited, did no work in 1920 other than sampling the Foley gold mine near Mine Centre, Ont. The officers of the company are: president, Senator George W. Fowler, Ottawa; vice-president, W. D. McKay, Toronto; secretary-treasurer, Gideon Grant, Toronto; directors: N. T. McMillan, Winnipeg; Clayton S. Corson, Toronto; C. R. Fitch, Fort Frances, Ont. H. R. Drummond-Hay, Winnipeg. Frank Carnegie, Mine Centre, Ont., is manager. s

Grace.—In the autumn of 1920 workmen were engaged in preparing the buildings and plant of the Grace gold mine on Eagle lake in the Manitou Lake region. It is planned to do some underground prospecting in No. 1 shaft. This shaft consists of two compartments, is 115 feet deep and from it 51 feet of lateral work was done some years ago. The work is being undertaken by The Grace Mining Company, Limited, whose Canadian office is at Fort Erie, Ont., and United States office at 300 Broadway, Buffalo, N. Y., Captain Walpole Roland, Box 515, Kenora, Ont., is supervising the work; the captain is 94 years of age and a veteran of the Crimea, the Indian mutiny, the Chinese expedition and the American civil war. Mail is sent to the mine via Vermilion Bay, Ont.

This mine should not be confused with the Grace gold mine in the Michipicoten region.

Wachman.—The Wachman Mining and Milling Company, Limited, carried on work south of Dryden until December, 1920, when the workmen were paid off. When work was stopped a two-compartment shaft, known as the No. 2 or west shaft, had been sunk 100 feet on a narrow quartz vein dipping at 85 degrees to the north, and eight feet of station cutting had been done on the 100-foot level. There is also a second shaft to the east, known as No. 1, which is 31 feet deep. Both shafts are on the southern part of claim K. 646.

The machinery in use consisted of a locomotive-type and a Jenekes marine boiler, a Canadian Rand straight-line compressor, and a James Cooper Manu-

facturing Company hoisting engine, 6-inch by 8-inch. Buildings added since last year are:- blacksmith shop, magazine, superintendent's house, and another log camp. Thirty-one men were employed, of whom four were working underground.

The officers of the company are: president, Robert Wachman, Dryden, Ont., vice-president, Edward L. C. Morse, Chicago; secretary and treasurer, A. Rosenberg, 1302 Milwaukee Ave., Chicago.

Iron Pyrites

Northpines.—The Northpines mine of the Nichols Chemical Company at Northpines, Ont., was operated during all of 1920 but stoping was stopped in October and for the remainder of the year only shaft-sinking was done. The last of the stockpile was shipped in November.

No. 1 shaft which consists of two compartments, has been straightened and is now vertical; it is 337 feet deep and is now connected with the fourth level workings. The main or No. 2 shaft, which contains three compartments, has been sunk to the sixth level and measures 624 feet on the slope; it is at 59 degrees for the first 320 feet and at 55 degrees for the remainder. In February, 1921, the fifth and sixth level stations were being cut and a skip-loading device was being placed above the sixth level. During 1920 pyrite was mined from the second level east, the third level east and the fourth level east and west.

A combined dormitory and change house has been built with a ground area of 11,800 square feet; it has a concrete basement and is plastered outside and in with cement plaster.

The head office of the company is at 25 Broad Street, New York and the head of the mining and metallurgical department is Robert H. Cromwell. The officers residing at Northpines are: superintendent, J. P. Flynn, Jr.; surveyor, A. G. Morrison; master mechanic, D. J. Rees; mine foreman, George Schmelzer. Until the reduction of force in the fall from 180 to 205 workmen were employed.

II.—THUNDER BAY, MICHIPICOTEN AND SUDBURY

Gold

Kirk Gold.—The Kirk gold mine, operated by Kirk Gold Mines Company, Limited, and situated on Bass lake north of Bruce Mines, was described in the Twenty-ninth Annual Report of the Ontario Department of Mines. When inspected on February 3, 1921, the underground work completed consisted of the following: the two-compartment shaft, which was sunk on the vein at 55 degrees, measured 126 feet; on the 50-foot level a drift extended 200 feet to the east and at 166 feet from the shaft a raise had been completed to surface - a distance of 210 feet; an adit level, the portal of which is near the shaft collar, had been driven 330 feet to the east. Fifteen men were employed at the time of inspection and all work was then being done on the adit level.

The head office of the company is in the Kent Building, Toronto; the post office address of the mine is Leeburn, Ont. The officers are: president, George A. Bull, Brampton, Ont.; directors, G. A. Gillespie, Peterboro, Ont.; R. B. Burrell, Toronto, Ont.; C. L. Messieur, Brantford, Ont.; secretary, Zeba Gallagher, Toronto. The mine manager is Major E. H. Birkett.

Manxman or Norwalk.—The Manxman or Norwalk mine is described in the Eleventh and Eighteenth Reports of the Bureau of Mines. It consists of 16 or 17 mining claims and is four miles east of the Mission in the Michipicoten region.

The Grace Mining Company, Limited, started overhauling the machinery in October, 1919, and began work underground in January, 1920. The company also had an option on the Grace gold mine nearby but did no work there.

The Manxman was inspected on May 5, when 26 men were employed and only shaft-sinking was being done. The shaft then measured 254 feet on the slope. It follows the vein which lies at about 45 degrees for 240 feet and at 75 degrees for the remaining 14 feet. Drifting has been done to the northwest on two levels; on the 110-foot for about 100 feet and on the 200-foot for 120 feet. The present owners did about 75 feet of the drifting on the 110-foot level and stoped to a height of 30 feet above the level. Some stoping was done on the 200-foot level by the former owners. A few days after the inspection was made, the company stopped all work.

The machinery at the mine includes the following: a 45 h. p. boiler; an Ingersoll-Sergeant compressor driven by a 50 h. p. General Electric motor; a Marsh and Henthorn hoisting engine, 6 inches by 8 inches; a 30 h. p. Westinghouse motor driving a 9-inch by 16-inch jaw crusher and also an aerial tramway leading from the crusher to the mill; three 50 k. w. Westinghouse core-type transformers, 10,000 primary to 220 secondary.

The mill ran for three weeks in February. It contains a boiler, a 46 h. p. engine and ten Fraser and Chalmers stamps No. 112, and amalgamating plates.

Electric power is obtained from the Algoma Power Company's plant at High Falls on the Michipicoten river.

The company is capitalized at \$1,000,000 and has its office at 1509 Cornelia Avenue, Chicago. The nearest post office to the mine is Michipicoten River, Ont. The officers of the company are: president, Wm. A. Burmeister, Chicago; vice-president, Henry Schefe, Appleton, Wis.; secretary, G. M. Bruss, Chicago; treasurer and manager, J. Martyn Stewart, Michipicoten River, Ont.

St. Anthony.—A syndicate consisting of C. L. Campbell of Montreal, C. P. Charlebois and W. H. Fairburn of Toronto, has obtained a lease of the St. Anthony mine on Sturgeon Lake and is treating tailings. In 1920, 1200 tons were reground and passed over amalgamating tables. No underground work was done.

Webb-McCarthy.—In December Major J. H. Rattray, acting on behalf of individuals whose names have not been made public, obtained an option on four of the Webb-McCarthy gold claims east of the Goudreau pyrite mine. The claims were staked in 1917 by W. J. Webb and D. J. McCarthy of Sault Ste. Marie, Ont.

Iron

Leitch.—The diamond-drilling being done on the Leitch iron claims, which are east of Lake Nipigon and six miles north of Beardmore station, was stopped in May, 1920.

Magpie.—The Magpie mine of the Algoma Steel Corporation, Limited, was worked during all of 1920, and the roast-plant was run except during period when repairs were being made. The output for the year amounted to 115,337 short tons of product; shipments totalled 106,241 tons all of which went to the Corporation's blast furnaces at Sault Ste. Marie, Ont.

The four-compartment vertical shaft now measures 591 feet to the bottom of the skip pit and 611 feet to the bottom of the drift beneath the pentice. When inspected on October 30, the orebody was being developed on the fifth level, and the drifts then extended 202 feet east and 169 feet west of the station cross-cut. There were 173 men employed at this time and 83 of these were underground workmen.

The officers of the mines department of the Corporation are: secretary, George S. Cowie, Sault Ste. Marie; mine superintendent, George R. McLaren, Magpie Mine, Ont.; assistant superintendent, Robert P. Weldon, Magpie Mine, Ont.

Moose Mountain, Limited.—Moose Mountain, Limited, operated its mine and mill at Sellwood, Ont., until November 29, when both were shut down. During 1920 there were treated 58,690 (long) tons of ore which yielded 24,242 (long) tons of briquettes.

The company is capitalized at \$4,000,000 and has the following directorate: president, Charles E. Herrman, Scarsdale, N.Y.; James C. Hutchins and John J. Mitchell, of Chicago; Wm. Mackenzie and Donald D. Mann, of Toronto; Chas. H. Smith. John B. Dennis, Augustine L. Humes, David Dows and John F. Harris, of New York. The secretary and treasurer is Albert Moreau, 17 Battery Place, New York and the head office is at Sellwood, Ont.

The officers resident at Sellwood are: general manager, A. J. Anderson; general superintendent, George C. Baer; mine superintendent, John G. Barron; mill superintendent, R. Sturgeon; master mechanic, C. A. Stahl.

Nickel and Copper

British America Nickel Corporation

Nickel and Copper.—The British America Nickel Corporation, Limited, owns nickel-copper mines and a smelting plant in the Sudbury district and a refinery at Deschênes, Que. The officers during 1920 were: president, James H. Dunn, New York; vice-president and managing director, W. A. Carlyle, Ottawa; secretary-treasurer, S. M. Brown; consulting engineer, A. Gronningsater, Ottawa; electrical engineer, R. F. Howard; purchasing agent, T. N. Hay; manager of mines, Ernest Hibbert; manager of smelter, E. J. Carlyle; manager of refinery, R. L. Peek; refinery superintendent, T. Torrel; chief engineer, J. H. Gillis. The Canadian head office is in the Jackson Building, Ottawa.

At the time of writing (March, 1921) a reorganization of the Corporation is being effected.

Nickleton Smelter.—The new nickel-copper smelter at Nickleton, Ont., was blown in on January 17, 1920. One furnace was operated for the remainder of the year, and for a short time two were in blast.

The following quotation is taken from an article by managing director W. A. Carlyle that appeared in the Canadian Mining Journal of March 18, 1921:

The smelting practice has many features different from that followed by the other smelters in the Sudbury district. The ore, averaging SiO_2 24%, Fe 35%, CaO 3.7%, MgO 4.3%, Al_2O_3 6%, S. 19%, is smelted without any preliminary roasting and the only flux is converter slag containing SiO_2 16%, Fe 52%, CaO 3.5%, Al_2O_3 3.5%, the charge consisting of 70 to 75% ore, the balance flux with 10.5% coke on the charge. The resulting slags contain SiO_2 35.5% Fe 30%, CaO 5.5%, Al_2O_3 13%, and 0.24 to 0.34% nickel plus copper plus cobalt.

The low-grade matte from this furnace, containing 11 to 13% nickel and copper, is poured into the converters, and blown up to the usual matte containing 80 to 82% copper and nickel and a trace of iron, which is transferred to an oil-fired furnace, and in running thence through a strong stream of water is very successfully granulated, then wheeled into box cars and shipped to the refinery.

In the converters the flux is mainly ore fines with some siliceous gravel or sand. One aim is to keep the silica in the converter slag as low as possible, it often averaging for days under 13%; this eventually will become the regular practice. This slag is run in part into 20-ton cars, poured outside the building upon shallow beds lined with ore fines, broken up and lifted by locomotive cranes using clam-shell buckets and sent to the smelter bins. Part of the slag is poured into the settlers.

The capacity of the blast furnaces is proving much greater than anticipated. For the past three months one furnace has averaged over 800 tons of ore per day, and 1,015 tons of ore have been smelted in one day, counting in the ore used as flux in the converters. In the future, greater results will be achieved especially if the ore fines under 1½ inches, now going to the furnaces, are sintered; this problem is now being studied. The flue dust, which is small in amount, is caught in the dust flues and chambers. The smelter stack is 300 feet high and 25 feet inside diameter.

The officers at the smelter are: manager of smelter, E. J. Carlyle; superintendent of smelter, Oliver E. Jager; blast furnace superintendent, T. Willard Cavers; converter superintendent, B. C. Tomlinson.

On February 26, 1921, the Corporation closed the smelter indefinitely owing to the condition of the metal market.

Murray.—The development work at the Murray mine of the British America Nickel Corporation, Limited, was continued throughout 1920, but the shaft was not sunk any deeper. Stopping has been started. The rock house has been in operation since January 16, 1920.

The officers at the Murray are: manager of mines, Ernest Hibbert and superintendent, H. L. Roseoc. The force at the end of the year numbered 400, of whom 300 were underground workmen.

With the exception of a few men, the mine employees were paid off on February 26, 1921, at the same time as the smelter was closed.

International Nickel Company of Canada

The International Nickel Company of Canada, Limited was licensed in Ontario on Jan. 6, 1917, and since that time has owned and operated the mines and smelter in the Sudbury district that were formerly worked by the Canadian Copper Company. The company also owns a nickel refinery at Port Colborne, Ont. The officers are: president, A. D. Miles, Toronto; vice-president and general manager, J. L. Agnew, Copper Cliff, Ont.; secretary-treasurer, James L. Ashley; directors, A. D. Miles, W. A. Bostwick, J. L. Agnew, Britton Osler, W. B. Lawson, Alfred Jaretzski, R. C. Stanley, John More. The head office is in the Harbour Commission Building, Toronto.

In 1920 the company had an average of 1623 employees in the Sudbury district; this number does not include those working on the construction of the Big Eddy dam, which was completed toward the end of the year.

The International Nickel Company owns all the stock of the International Nickel Company of Canada, Limited. The authorized stock of the parent company consists of: \$50,000,000 in common shares (par \$25), \$41,834,600 outstanding; and \$12,000,000 in 6% non-cumulative preferred shares (par \$100), \$8,912,600 outstanding. The officers of the parent company are: president, W. A. Bostwick; 1st vice-president, R. C. Stanley; secretary-treasurer, James L. Ashley; comptroller, James W. Beard; directors, E. C. Converse (Chairman of the Board), W. A. Bostwick, Admiral Willard H. Brownson, Ambrose Monell, Chas. Hayden, A. D. Miles, W. E. Corey, William T. Graham, Thos. Morrison, Alfred Jaretzski, R. C. Stanley, William Nelson Cromwell, Seward Prosser. The general offices are at Constable Hook, Bayonne, New Jersey, and the executive and financial offices at 67 Wall Street, New York.

The officers residing in Copper Cliff, in addition to those mentioned elsewhere in this report, include: vice-president and general manager, J. L. Agnew; general superintendent, J. C. Nichols; superintendent of mines, E. T. Corkill; master mechanic of mines, David Butchart; electrical superintendent, J. B. McCarthy; transportation superintendent, G. A. Sprecher; safety engineer, William O. Tower.

The following information is abstracted from the nineteenth annual report of the parent company and covers the fiscal year ending March 31, 1921.

Condition of Plants and Reserve Accounts.—During the fiscal year a sum of \$1,356,811.47 was expended for additional property, construction, and equipment as follows: Port Colborne plant \$6,862.48, Copper Cliff smelter and hydro-electric plant \$1,087,984.99, Orford works \$84,815.23, and the Huntington plant \$177,148.77. Recoveries for the same period were \$42,200.97, making the net addition to Property Account \$1,314,610.50.

There has been provided out of the earnings the sum of \$2,147,150.15 for the following funds: Regular allowance for depreciation \$1,577,312.59, and exhaustion of minerals \$569,837.56.

Inventories.—The inventories, amounting to \$11,891,078.23, include the following items: ores, matte and metals in process \$5,259,130.23, refined metals \$4,211,234.80 valued at cost, in no case in excess of present market value, and general supplies, flux, fuel, etc. \$2,420,713.20, valued at cost or replacement value as of March 31, 1921.

Net profits for the Year.—The net profits for the fiscal year, after deducting expenses, depreciation, exhaustion of minerals, provision for foreign and United States taxes and all other charges, were \$2,029,699.83, which, after paying the 6% dividends on the preferred stock, is equivalent to approximately 3.6% on the common stock, or 90 cents per share of par value of \$25.00.

Surplus.—The company's surplus is now \$11,886,177.21, as compared with \$10,391,233.38 on April 1, 1920.

General.—During the first six months of the present fiscal year a fair volume of business was done, but during the last six months, as the general industrial depression increased and the deflation process progressed, the volume of business was very materially decreased.

There were stocks of nickel, as well as secondary or scrap metals, still remaining in the European markets at the beginning of the year, and these have been only partly liquidated during the year. The continued unsettled conditions in the European consuming industries, together with the presence of the stocks already referred to, the difficulties of financing purchases and the abnormal conditions of foreign exchange have caused the volume of foreign business during the year to be inconsiderable. The indications of the last two months in the United States, however, are that stocks in many consumers' hands are gradually becoming exhausted, and the result has been an increased demand, not as yet large in volume, but from an increasingly large number of consumers.

During the first half of the fiscal year the company's operations were at (approximately) sixty per cent capacity. In the second half, as the volume of business became less, the operations were restricted, until at the conclusion of the year the plants were being operated at about twenty per cent capacity, but with sufficient organization retained, and with the plants maintained in such condition as will enable them to increase operations quickly, as the demand for the company's products increases.

It is encouraging to be able to report that considerable progress has been made during the year in the development of markets for Monel metal and nickel in various rolled forms produced by the company, and the prospects of continued expansion in these lines are excellent. To provide the facilities necessary to develop further this profitable branch of its business, the company has decided upon the construction of rolling mills of its own, which will enable it to provide the service in deliveries and quality of these rolled products so essential in expanding the market for their uses. The company has acquired an excellent site of approximately eighty acres on the Guyandotte river near Huntington, West Virginia, with the facilities in fuel, power, transportation, and labour admirably adapted to its needs. The construction of this plant is now actively progressing and it is anticipated that the plant will be producing before the close of this year.

During the year four quarterly dividends of 1½% each on the preferred stock of the company have been paid out of the earnings of the fiscal year. No dividends have been declared or paid on the common stock, it having been deemed advisable to maintain the financial position of the company and to conserve its cash resources for such further capital expenditures as will be necessary to complete the new rolling mills now under construction.

The number of stockholders is now 16,206.

Creighton Mine.—During 1920, the Creighton No. 3 shaft (55 degrees) was sunk still deeper; it now consists of five compartments to a vertical depth of 1527 feet and one compartment from this point to a vertical depth of 1880 feet below surface. At the bottom of this shaft the 30th level has just been started. A 45-degree winze, known as "No. 10 hanging-wall winze", extends from the 20th to the 30th level - a vertical distance of 600 feet. Diamond-drilling is being done from two points in this winze.

The average number of men employed at the Creighton during the year was 591, and the shipments of ore totalled 783,292 tons, as compared with 356,143 tons in 1919.

The staff at the mine includes: superintendent, Geo. A. Morrison; assistant superintendent, W. J. Rolfe; mine foremen, K. C. Browne and Chas. Collins; master mechanic, John Symons; electrician, Everett Gillespie.

Frood or No. 3 Mine.—This mine has not been worked by the International Nickel Company since August 8, 1914. In the summer of 1920 it was bailed out and 100 tons of ore obtained for experimental purposes. The mine was then allowed to fill again. Some diamond-drilling was also done from the surface until power became scarce owing to the summer drought.

Dill quarry.—Dill quarry at Quartz, Ont., was worked during the summer of 1920, and 68,302 tons of quartzite were shipped to Copper Cliff smelter for flux. In September the pit covered an area of 161,850 square feet and averaged 60. feet in depth. W. H. Roach was superintendent until August, when Walter Blackwell took charge. Sixty men were employed.

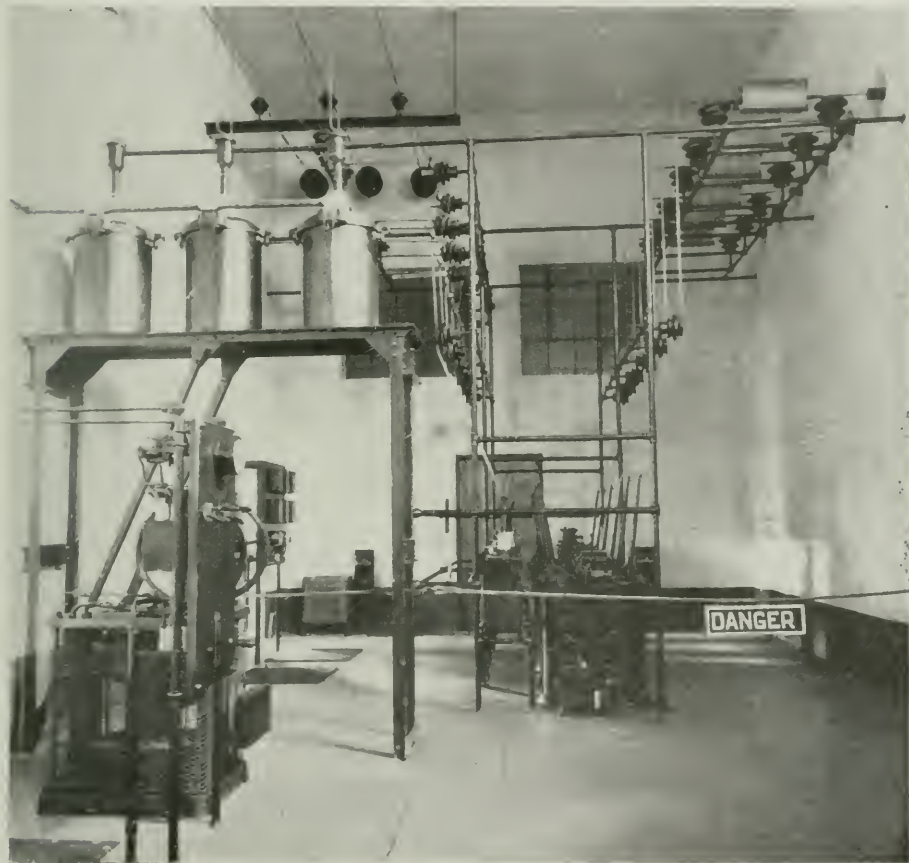


Fig. 1—Main high tension line switching structure.
International Nickel Company, of Canada, Limited.

Copper Cliff Smelter.—The average number of blast furnaces in operation at Copper Cliff in 1920 was between four and five. The reverberatory furnaces and some of the Wedge furnaces were run all year.

Construction work done consisted of: the veneering of the smelter powerhouse, the adding of a new switch room to this building, and the erection of the steel frame-work to house a Dwight-Lloyd sintering plant.

The officers at the smelter are: superintendent of smelter, Wm. Kent; assistant smelter superintendent, Donald MacCaskill; metallurgist, James W. Rawlins; master mechanic of smelter, George R. Craig; blast furnace foreman, Peter McDonald; converter foreman, Frank Taylor; reverberatory furnace foreman, J. K. Workman.

Substation.—Extensive additions and alterations to the main substation at Copper Cliff were recently completed. The major portion of the power developed at its hydro-electric plant is distributed from this point, and all load dispatching and switching for the various mines and other operating properties is under the control of the Copper Cliff operators.

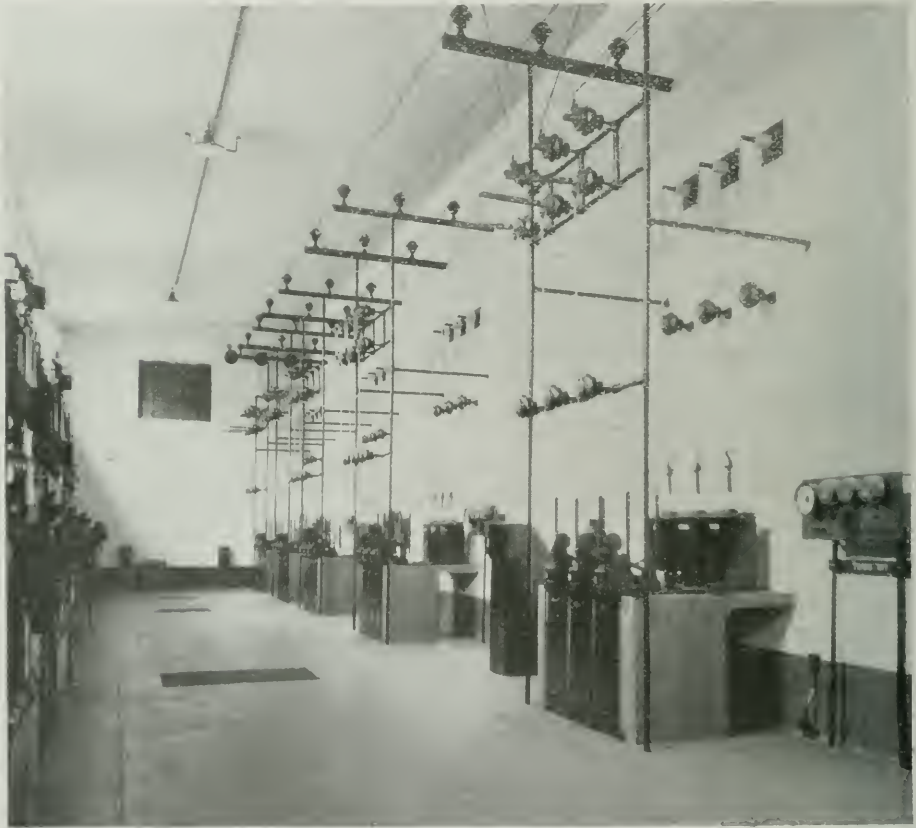


Fig. 2—High tension transformer switch structure.
International Nickel Company of Canada, Limited.

A large increase in generating capacity at the power plant, and also the increase of connected load, particularly that driven by synchronous motors, rendered necessary the replacing of the old switching equipment with a more modern design having a larger rupturing capacity. At the same time it was decided to so lay out the plant that maximum security to life and property would be secured without resorting to unnecessary complications. In the selection of the equipment the ultimate development of the hydro-electric plant was considered.

Current is delivered to this substation at 33,000 volts, three phase, 25 cycles, over two parallel lines mounted on the same pole structure from the company's hydro-electric plant at High Falls. A main terminal tower close to the entrance serves as a support for the complete electrolytic lightning arresters equipment, and also for a three pole lever-operated Burke horn-gap switch for each line. All power can be completely cut off outside the station, in an emergency, by means of these switches.

From the tower, the two lines enter the building through porcelain bushings cemented in the brick wall. Immediately inside are the line suspension choke coils from which the lines pass through heavy oil circuit breakers (Fig. 1) with condenser bushings and disconnecting switches, to the main high tension bus bar. The high tension bus bars are supported on 44,000 volt pin-type insulators with strain insulators at each end. From this bus bar, current is distributed through high tension oil circuit breakers with disconnecting switches to four banks of transformers with a normal capacity of 2,000 K. V. A. each (Fig. 2). Each bank consists

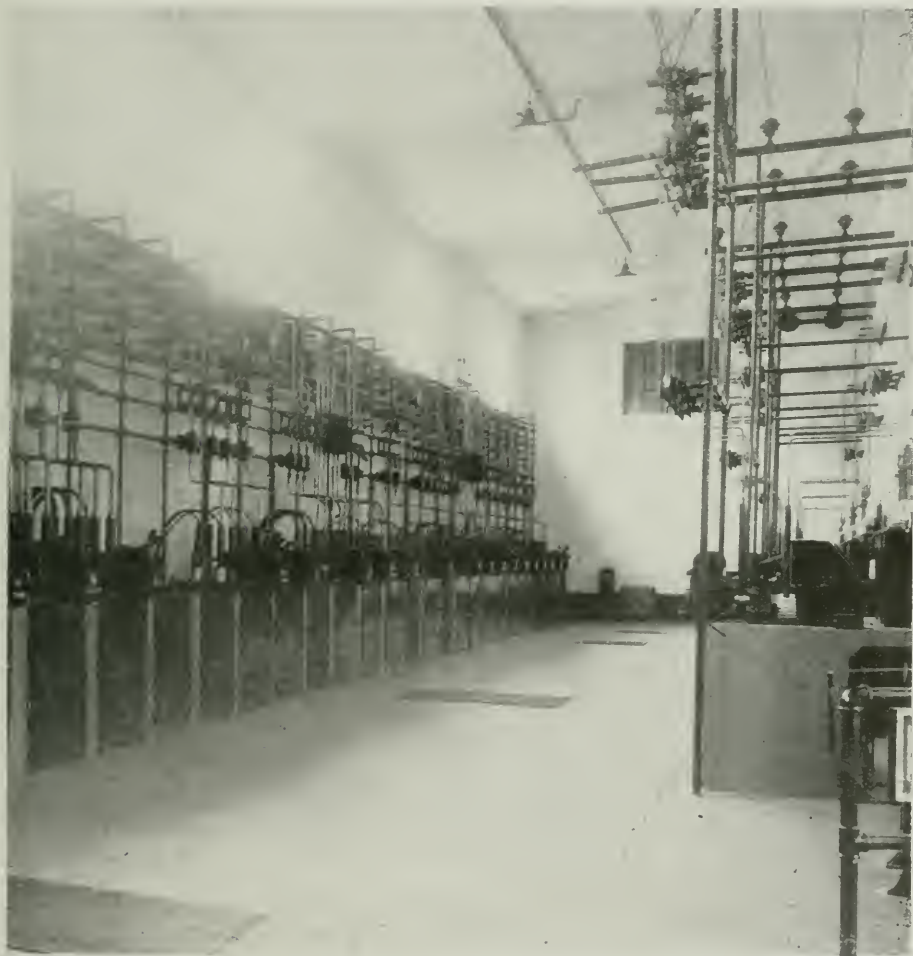


Fig. 3—Main 2,400 volt switching structure.
International Nickel Company of Canada, Ltd.

of three single phase oil-insulated water-cooled transformers, which reduce the voltage from 33,000 to 2,400 volts. Each bank is enclosed in a separate fire-proof compartment and each transformer is provided with wheels and mounted on rails to facilitate placing it under the crane for repairs.

The low tension bus bar (Fig. 3) is divided into four sections by means of bus tie oil circuit breakers. Ground detectors are suitably placed, and used in conjunction with the bus tie breakers, serve to isolate a ground quickly on the 2,400 volt

lines. All lines going outside the station are connected to one bus section, and at time of lightning disturbances this section is isolated from the others, thus confining the disturbance to a single section.

From the 2,400 volt bus bar current is distributed through a heavy duty feeder oil circuit breaker and disconnecting switches to the starting panels (Fig. 4) of each large motor, and to a transformer bank of 500 K. V. A. capacity at 550 volts. A small bus for the town and plant lighting, another for motor generator sets and fire pump are each protected in the same manner.

The small distributing bus bar structures (Fig. 5) are mounted on a gallery immediately above the main operating board (Fig. 6) and all circuit breakers on this structure are mechanically operated from the main board below.

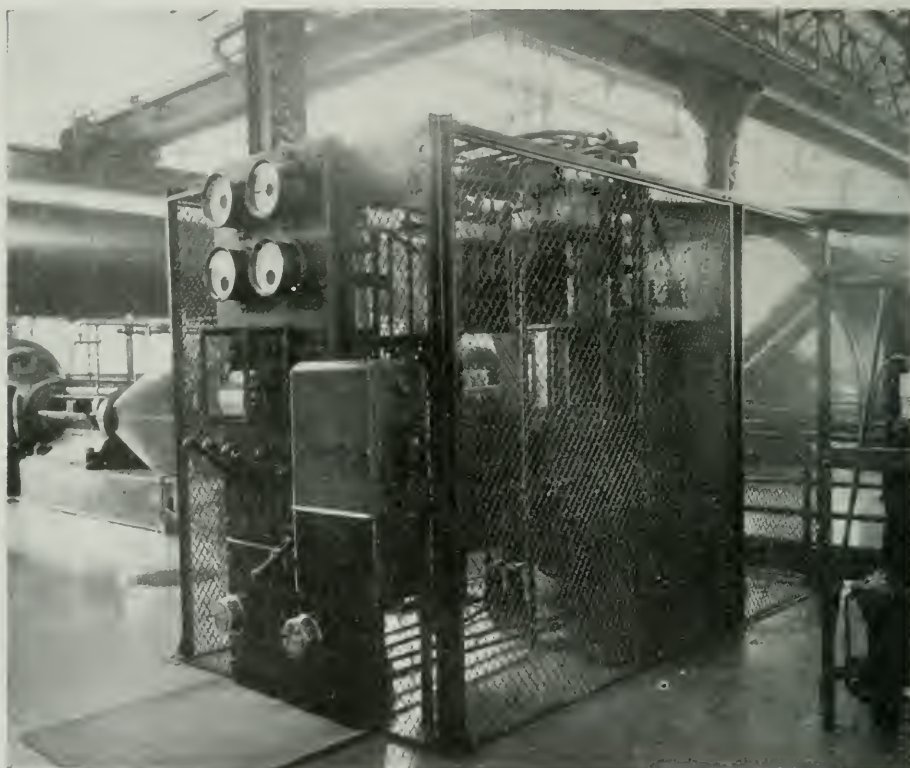


Fig. 4—R. B. S. motor starting panel. International Nickel Company of Canada.

In connection with the 2,400 volt distribution, it might be interesting to note that of the total connected load, approximately 10,000 H. P. is for air compressing (Fig. 7) for blast furnaces, converters and shops. Of the motors, probably the most interesting is the 2,600 K. V. A., 1,500 R. P. M., 2 pole synchronous motor driving a large centrifugal converter blower. This is believed to be the largest 25 cycle motor of this type built to date.

All main circuit breakers, both high and low tension, are electrically operated through solenoids. Energy is obtained for these, as well as for the various indicating and signalling devices, from an Edison storage battery. The battery is charged from the locomotive circuit.

In order to get a proper record of the distribution of power, meters have been installed as indicated. Each feeder is provided with an ammeter operated from a rotary switch for reading the current in each phase. Totalizing meters, both of the graphic and integrating type, are connected to record the total input, while a recording voltmeter and wattless component meter indicate the voltage and wattless current respectively. Whenever further division is required, the necessary meters are installed.



Fig. 5—Bus structure for auxiliary. International Nickel Company of Canada, Limited.

Protection of the equipment has been given careful consideration and the salient feature of the scheme adopted follows; first of all, every oil circuit breaker has a set of disconnecting switches to isolate it from the source of power. The main line circuit breakers are connected through reverse power relays actuated from current transformers in each phase to open, in case of trouble on either line, the circuit breaker that will cut out the line in trouble. The same current transformers are also connected through overload relays to cut either or both main circuit breakers in case of overload.

Each transformer bank is provided with a current transformer on each phase, both high and low tension operating in connection with relays on the differential plan to cut out both high and low tension transformer breaker in the event of trouble in a transformer. The transformers, by a slight unbalance between the high and low tension current transformers, are further protected against overload external to the transformer with the same arrangement.

Each feeder breaker is equipped through relays with overload protection. When the feeder breaker supplies a large motor, additional protection is provided through the overload breaker on the starting panel. When the feeders supply a small distributing bus, the individual feeders from this bus bar are similarly protected.

All relays are of the wattmeter type and therefore, a selective action is obtained all over the system, tending to isolate troubles and reduce the interruptions to a minimum.

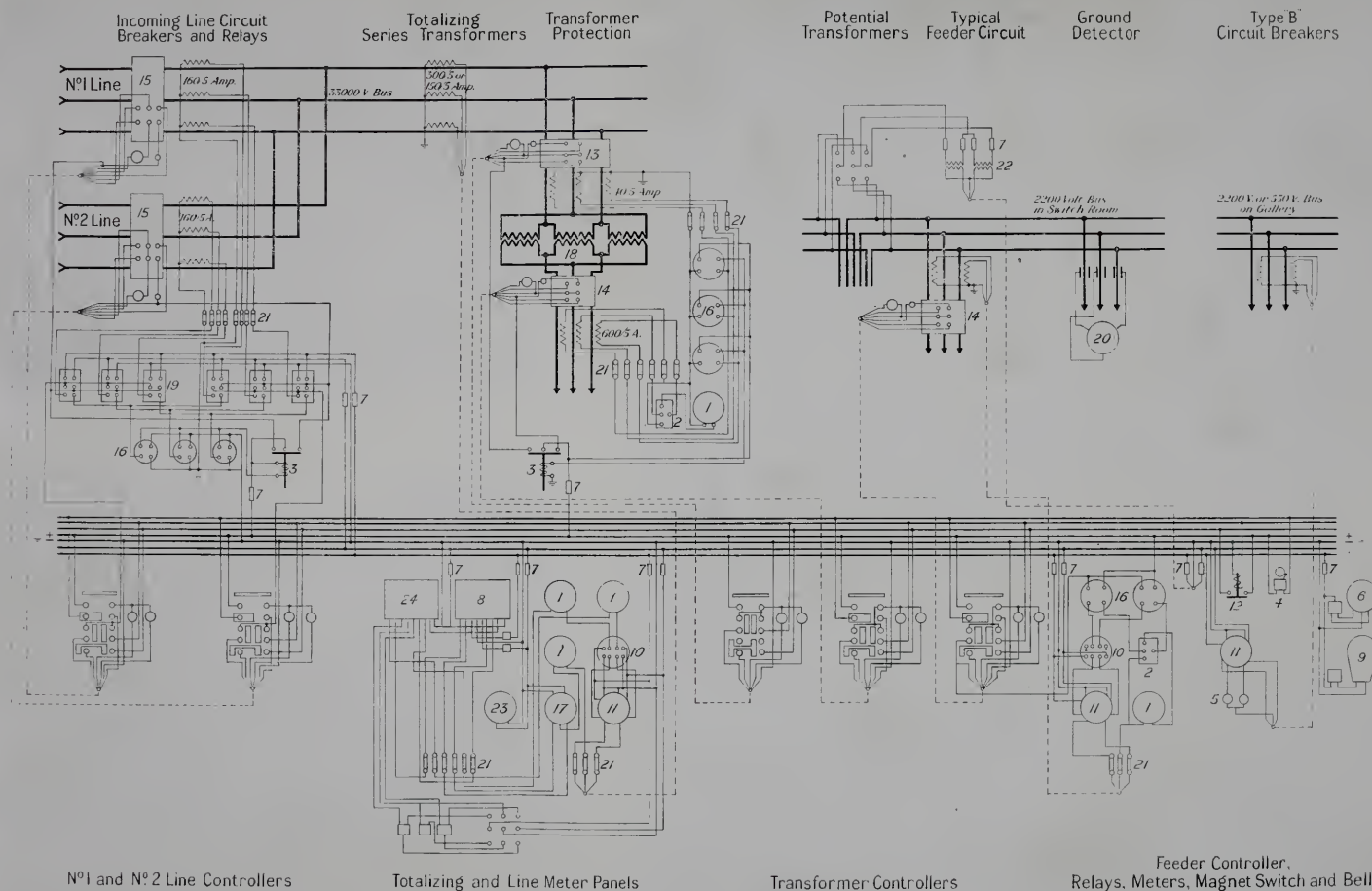
All power cables, also control and meter wiring are run in either fibre duct or iron conduit to the various points, and large pull boxes are provided to render inspection and installation easy. A large number of spare ducts and cells are installed for future developments.

An oil treating outfit is installed to take care of the transformer oil. This includes two large tanks, one placed above the transformers, the other in the basement, and the necessary piping. An oil filter and dehydrator is also provided to clean the dirty oil. With this outfit, transformer oil is quickly and easily handled.

Very effective lighting has been secured from using gas filled lamps of large size with deep bowl reflectors installed above the crane track. The units are spring suspended to protect the lamps from vibration. The switch room is electrically heated with 8 K. W. air heaters operated from a 550 volt circuit.

All switching equipment was supplied by The Canadian Westinghouse, Limited, and installed by The International Nickel Company of Canada, Limited.

The accompanying diagram (insert) shows the arrangement of high and low tension lines, feeders, etc. In addition it shows the meter and control for the high tension lines and also typical transformer and feeder control and metering diagrams.



EXPLANATION OF REFERENCE NUMBERS.

- 1—Ammeter.
- 2—Ammeter Switch.
- 3—Ammeter Relay, 3 point.
- 4—Bell.
- 5—Circuit Breaker, type "B," Overload Coils.
- 6—Frequency Meter.
- 7—Fuse.
- 8—Graphic Totalizing Wattmeter.
- 9—Graphic Voltmeter.
- 10—Indicating Wattmeter.
- 11—Integrating Wattmeter.
- 12—Magnet Switch.
- 13—Oil Circuit Breaker, type "F."
- 14—Oil Circuit Breaker, type "E. H."
- 15—Oil Circuit Breaker, type "G. A."
- 16—Overload Relays, type "C. O."
- 17—Power Factor Indicator.
- 18—Power Transformers.
- 19—Reverse Power Relays, type "C. R."
- 20—Static Ground Detector.
- 21—Test Links.
- 22—Transformers, two 2K. V.A., 2000-100 Volts.
- 23—Voltmeter.
- 24—Wattless Component Meter.

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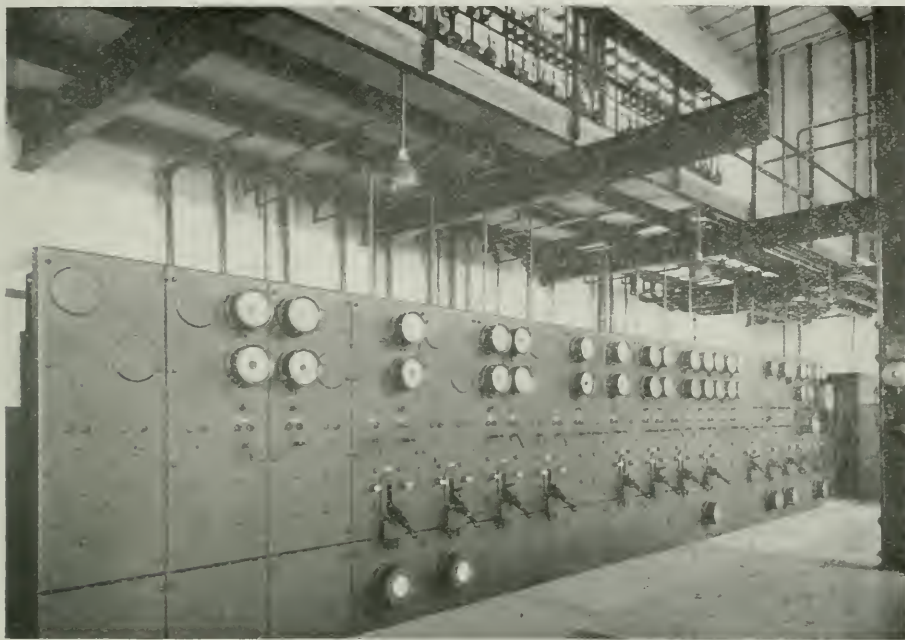


Fig. 6—Main operating panel board.

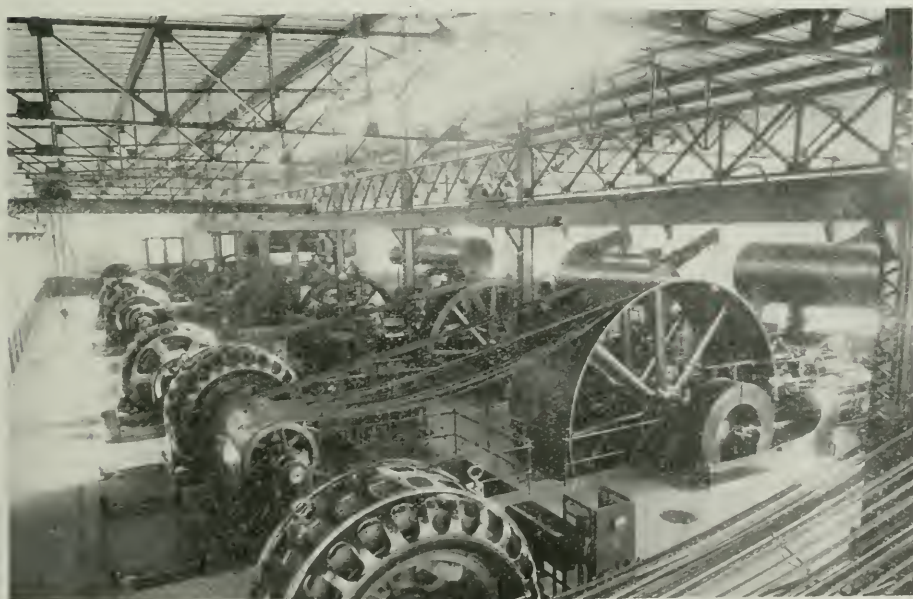


Fig. 7—Smelter compressor building.
International Nickel Company of Canada, Limited.



INTERNATIONAL NICKEL COMPANY OF CANADA, LIMITED

Big Eddy conservation dam, gravity type, on the Spanish river, lot 2, concession II, Hyman township, three-fourths of a mile above the present power development at High Falls. The dam (length 1125 feet, maximum height 146 feet) contains 89,704 cubic yards of concrete, including 4685 cubic yards in caisson piers.

Big Eddy Dam.—This conservation dam is on the Spanish river in lot 2, concession II, township of Hyman, three-quarters of a mile above the present power development at High Falls.

The dam is of gravity type and contains 80,704 cubic yards of concrete, including 4,685 cubic yards in caisson piers. Total length of dam is 1,125 feet, consisting of west wing and non-overflow section of 102' 6", an overflow section of 173', a regulating sluice section of 60', an overflow section with log-slide and trash-run of 240' 6", a head work section of 164', and an east wing and non-overflow section of 385'. Greatest height of dam from river bed to top of overflow section is 146'. Greatest thickness of dam at regulating valve tube is 100'. Thickness at bottom of dam at penstock section is 78', and the width at top ranges from 36' over the penstock section to 5' at top of non-overflow sections.

Regulating sluices for draining off from storage are three in number, controlled by Larner-Johnston hydraulic operated valves. Regulating valves have cast iron bodies 5' 10" thick and 9' 11½" at greatest diameter.

Overflow sections are divided by piers into 17' bays, and provided throughout with guides for stop logs.

The log slide is of reinforced concrete supported by concrete arches at inner end and the outside end rests on solid rock. The log slide is 330' in length, inside width at dam 8', tapering to 4' at lower end.

Mond Nickel Company

The Mond Nickel Company was incorporated in Great Britain on September 20, 1900. The capitalization of the company is now £3,400,000 made up as follows: £500,000 in 7 per cent cumulative preferred shares, par £1; £2,000,000 in 7 per cent non-cumulative preferred shares, par £1; £900,000 in common shares, par £1. The secretary's office and the sales office are at 39 Victoria Street, London, S. W. 1, England; the Canadian office is at Coniston, Ont.; and the refining works are at Clydach, Wales. The secretary is D. Owen Evans.

The directors of the company are: chairman, Robert L. Mond; Sir E. J. Griffith, S. W. A. Noble, Sir Robert Hadfield, Emile S. Mond, Dr. Carl Langer, Robert Mathias, Sir Byron Edmund Walker, C. V. Corless. C. V. Corless, Coniston, is managing director, and O. Hall, Coniston, superintendent of mines.

Coniston Smelter.—One blast furnace and one converter, out of four furnaces and four converters, were operated during 1920 at the Mond Nickel Company's smelter at Coniston. No heap roasting has been done since 1918.

J. F. Robertson is superintendent of reduction works, E. T. Austin superintendent of the smelter, and K. S. Clarke superintendent of the sintering and flotation plants.

Bruce Mines.—The shipments of siliceous copper ore from the Bruce copper mines at Bruce Mines, Ont., to Coniston smelter totalled 25,639 tons for the year.

At the Taylor shaft drifting was continued on the vein on the 155-foot level until the face was 1,907 feet to the southeast of the shaft; 650 feet of back was cut out to a height of 12 feet and made ready for stoping. All work was stopped at this shaft on September 30, 1920.

At 'old No. 4' shaft the following work was done: on the fourth (320-foot) level a pillar was removed above No. 54 stope; on the fifth (420-foot) level No. 54 stope was worked out and at 1550 feet to the northwest of the shaft a raise was driven to the 225-foot level of the Western shaft connecting at a point 25 feet to the south-east of the western shaft bottom.

At the Western shaft a little stoping was done above and below the 225-foot level.

At "old No. 2" shaft part of the shaft pillar was drawn and some stoping was done between this shaft and the Western under a caved area between 265 feet and 340 feet from the surface. This is supposed to be in the vicinity of the Palmer shaft, where an extensive cave-in occurred about 1876. In doing this stoping an old winze, having a drift and crosseut at the bottom, was encountered to the west of the caved area; 70 feet of this winze remained intact, but the upper part had been crushed. In the drift at the bottom of the winze there were found two of the old type of Cornish wheelbarrows and the miners' tools as they had left them when going off shift—probably at some time in 1876.

It may be worth recording that on the 420-foot level of "old No. 4" shaft at the face of a crosseut to the southwest of No. 51 drift a pink to white quartzite is exposed for 35 feet. The contact of this quartzite with the diabase dips at 10 or 15 degrees to the southeast. This is the only point in the underground workings where quartzite is known to have been found.

In February, 1921, all work was stopped at these mines and they were allowed to fill.

A. D. Carmichael, who was in charge here for some years, was transferred to the Worthington mine early in 1920; he was succeeded at the Bruce mines as superintendent by H. A. Steven, who remained in charge until the mine was closed. The working force numbered 60.

Garson.—The Garson mine shipped 35,541 tons of ore to Coniston in 1920. Stoping was carried on between the third and sixth levels and the third-level floor pillar was taken out. On the tenth (1,000-foot) level 150 feet of drifting was done. From 70 to 80 men were employed.

Captain A. L. Sharp is superintendent, and Chas. Caesar and Alex. Pollock, mine foremen.

Victoria.—At the Victoria mine the number of men employed in 1920 varied from 50 to 85. The only new development work undertaken was the sinking of a winze on the west orebody to a depth of 34 feet below the eighteenth or 3,000-foot level. At the bottom of this winze a small amount of ore was taken out; stoping was also done on the west orebody above the second, fourth and sixteenth levels. Floor pillars were removed on the thirteenth and fourteenth levels and part of that on the sixteenth was taken out. Shipments for the year amounted to 20,915 tons.

W. J. Mumford, Mond, Ont., is superintendent.

Worthington.—No development work was done at the Worthington mine in 1920. Stoping was continued east of the shaft above the third, fourth and fifth levels and west of the shaft above the fourth and fifth.

The shipments for the year amounted to 20,375 tons and about 70 men were employed.

J. G. Harris resigned as superintendent in March and was succeeded by A. D. Carmichael of the Bruce mines. Wm. McKerrow is mine foreman.

Levack.—The work accomplished at Levack mine in 1920 was as follows: raising, 385 feet; drifting, 365 feet; diamond drilling, 2,013 feet; section cutting, 19,029 square feet; ore shipped to Coniston, 31,820 tons. Stoping was done only above the fifth level and chiefly in No. 54 stope. From 70 to 80 men were employed.

The mine officers in 1920 were: superintendent, Frank J. Eager, and mine foreman, Andrew Taylor.

Morin.—In November and December, 1920, some diamond-drilling was done on the Morin property, which lies to the northwest of the Crean Hill mine. It consists of the north half of lot 6, concession V, Denison township and is owned by Joseph Morin and J. McFadden of Sudbury.

Iron Pyrites

Goudreau.—The Nichols Chemical Company, Limited, stopped work on January 9, 1920, at the Goudreau pyrite mines, Goudreau, Ont. During the summer pyrite was shipped from the stockpile at the mine. D. J. Rees was superintendent.

Morrison No. 3.—The engine house, change house and blacksmith shop at the Morrison No. 3 property of the Nichols Chemical Company, Limited, were destroyed by fire on November 26, 1919; the headframe was not damaged. Since the fire no work has been done at this property.

When the fire occurred, the development work done in the mine was as follows: the three-compartment shaft on claim A. C. 40 measured 230 feet at an angle of 47 degrees; on the 100-foot level about 347 feet of drifting and crosscutting had been completed, and on the 210-foot level about 848 feet. D. J. Rees, Goudreau, Ont., was superintendent.

Rand Consolidated.—Rand Consolidated Mines, Limited, (capitalized at \$5,000,000) which has been carrying on work in the Goudreau area for several years past did nothing in 1920 on the Morrison No. 4 property near Goudreau Station but began to prospect the Morrison No. 2 group of claims a mile and a quarter south of Goudreau Station. In June all work was stopped.

The last inspection was made on May 4, when an adit was being driven west on the Morrison No. 2 into a high ridge west of mileage 175.75 of the Algoma Central and Hudson Bay railway. The portal is 1,200 feet west of the railway and 250 feet above it. On the date mentioned the adit was 107 feet into the hill and measured 13 feet in width; the height of the first fifty feet was 12 feet and of the remainder 9 feet. This adit is driven in the footwall of the more southerly of one of two bands of iron formation that strike west, dip to the north at 70 degrees and are some 600 feet apart. It was stated that the company planned to mine both pyrite and siderite from the south deposit.

Near the portal a change house and blacksmith shop had been completed, and beside the railway an office and large log sleeping and dining camps were being built. There were 70 men employed of whom 32 were working in the mine in three shifts.

The head office of the company is at 621 Farmers' Bank Building, Pittsburgh, Pa.; Edwin Ohl is president and Fred E. Powers treasurer; both of Pittsburgh. The resident officers were general manager, John T. Jones, Goudreau; superintendent, Edward C. Gluck; mining engineer, A. E. Flynn.

Silver

Federal Mining Company, Limited.—This company was incorporated on November 10, 1919, with a capitalization of \$40,000, to prospect a claim for silver some thirteen miles west of Fort William in lot 26, concession B, Paipoonge township. The officers of the company are: president and manager, Franklin S. Wiley, 213 Park St., Port Arthur; director and secretary, F. Cranford Gibbs, Port Arthur; directors, W. L. Brown, Chicago, Ill., W. D. B. Turville, Port Arthur.

Work was started in January, 1920, and at the end of the year a shaft had been sunk on the vein for 75 feet and at the bottom 15 feet of drifting had been done to the northwest and 11 feet to the southeast. When the last inspection was made in September, the vein which strikes in a northwesterly direction showed a dip of 65 degrees to the southwest; it was from 32 to 48 inches in width and consisted of calcite, quartz—a little of which is amethystine—some pyrite and occasional specks of zinc blende and galena; argentite is said to have been encountered in several places in the shaft. The wall rock is slate. Eight men were employed under the direction of foreman George Copeland.

Silver Islet.—The Silver Islet mine near Thunder cape is owned by The Nipigon Mining and Lands Company, of which Sydney T. Miller, Penobscot Building, Detroit, Mich., is secretary.

After lying idle since the early part of 1884, this mine was pumped out by means of an air-lift to a depth of 110 feet and sampled by R. C. Jamison and D. C. Peacock, 509 Alworth Building, Duluth, Minn. Preparatory work was started in May and the sampling of this upper portion of the mine was completed at the end of July; after this was done, the mine was allowed to fill again. Contrary to the general opinion the mine does not make much water. During the following winter some diamond-drilling was done from the surface of the island, and it is the intention to do some crosscutting in 1921. Jamison and Peacock have provided a locomotive-type boiler and a Canadian Fog Signal air compressor 12 inches by 14 inches by 12 inches. Charles W. Greenlee supervised the pumping and sampling and had eight men employed.

A fire on May 15, 1920, destroyed the two shafthouses, the engine house and the office.

Porcupine.—Jamison and Peacock of Duluth did 30 feet of crosscutting in January and February, 1920, on the second level of the Porcupine silver mine in the Rabbit Mountain area.

Quartz Quarries

Bellevue.—The McPhail and Wright Construction Company, Limited, of Sault Ste Marie, Ont., worked its quartz quarry on the Algoma Central near Bellevue during the summer. The rock quarried is a quartzite, probably of the series generally referred to as 'iron formation.' There is no power plant at this quarry, the drilling being done by hand and the cars lowered to the bins at the railway and returned by means of a gravity plane. Fifteen men were employed when the quarry was inspected on June 29, 1920. The quartzite is sold to the Algoma Steel Corporation.

Kenneth Wright, Sault Ste Marie, Ont., is manager of the company and C. L. Aronson is quarry foreman.

Killarney.—The quartzite quarry near Killarney, which had been closed down since October, 1918, was worked during the season of navigation by Electro-Metals, Limited, with a force of from 20 to 25 men.

Since the equipment at this quarry was described in the Twenty-Fourth Annual Report of the Ontario Bureau of Mines, numerous changes have been made. The quartzite in the pit is now loaded by a Marion steam shovel into cars, which are hauled up an incline to the crushing plant by a Beatty and Sons'

three-drum contractor's hoisting engine. In the crusher house are: a Power and Mining Superior jaw crusher with 40-inch by 42-inch jaw opening, a 48-inch trommel with 5-inch openings, a No. 6 Gates gyratory crusher, a 36-inch pan conveyor and a rail grizzly. From a small bin the crushed material feeds upon a horizontal conveying belt, which discharges above a stockpile. Beneath the stockpile is a tunnel containing a belt conveyor, used in loading the boats. The power house contains; a Jenckes and a Polson return tubular boiler, a 200 h. p. Robb-Armstrong engine, a Canadian Rand 14-inch by 22-inch compressor, a Fairbanks-Morse dynamo, and a Marsh and Henthorn 5-inch by 7-inch hoist for raising coal from the lake shore to the boilers. A machine shop has been built and equipped with a Bertram lathe, a Smith and Mills shaper, a Novo gas engine, a 24-inch drill, and a Clark emery grinder.

George W. Rayner, 410 Crown Office Building, Toronto, is manager and Dan Chisholm, Killarney, Ont., foreman.

Trap

City of Fort William.—The city of Fort William has for several years been obtaining trap for road building from a quarry at the foot of mount McKay near the rifle ranges. In June, 1920, this quarry was abandoned and a crushing plant was being set up nearby to crush trap talus at the foot of the mountain. This work is in charge of Cyril Symmes, city engineer, Fort William.

Marrigan.—Chambers, McQuigge and McCaffrey Co., Limited, continued to work the Marrigan trap quarry at Bare point, Port Arthur, during 1920 and had 65 men employed. The rock is all used for the breakwater in Port Arthur harbour.

The machinery in use at this quarry includes: a Canadian Ingersoll-Rand 16 by 10 by 12-inch compressor driven by a 100 h. p. motor, a Marion steam shovel, and four dinkey locomotives.

C. McQuigge, Walsh Block, Port Arthur, is manager.

III.—DISTRICT OF TIMISKAMING

Gold

Boston Creek

Miller Independence.—The Miller Independence Mines, Limited, continued in 1920 to prospect their property, which consists of the south half of lot 1, concession VI, Pacaud township, in the Boston Creek area. The officers of the company are: William Stroop, president; George W. Ozias, vice-president; John C. Schaeffer, secretary treasurer. The other members of the board of directors are: O. B. Brown, John A. Read, J. A. Begard, B. B. Van der Voort, Philo G. Burnham, T. E. Tucker. W. E. Simpson, Boston Creek, Ont., is manager, and an average of 30 men is employed.

The following account of the work done in 1920 is summarized from the report of the manager:

Electrical power is now used at this mine instead of steam. This change has necessitated the expenditure of nearly \$50,000 and has involved the building of over two miles of transmission line and a sub-station. The boiler plant is being kept as a reserve. The pistons were removed from the air compressor and a 100 h. p. motor provided to operate it by means of a belt leading to the fly wheel from a jack shaft.

The main or "A" vertical, two-compartment shaft, which was 427 feet deep at the beginning of the year, was sunk to 515 feet, and a level opened at 500 feet. A crosscut has been driven northward on this level for 525 feet and will be continued to the northern boundary. At slightly less than 200 feet from the shaft a fracture was encountered, that is believed to be the downward continuation of one encountered in the "D" shaft. A drift, headed northeast along this fracture, had advanced 52 feet at the end of the year. On meeting the fracture a crosscut was also started westward towards the "Jumbo" vein; this crosscut measures 315 feet. At a point 320 feet north of the shaft 64 feet of crosscutting due east was done.

In the "D" shaft, which is a 45-degree incline, 35 feet of drifting was done on the 200-foot level. On the surface a rock-cut, over 200 feet long, was excavated to divert a creek and thereby prevent the seepage from finding its way into the "D" workings.

A laboratory sampling equipment, consisting of a Sturtevant crusher, a set of rolls, and a small concentrating table, has been purchased; this will handle sample lots of ore of 40 or 50 pounds.

Beatty Township

Premier.—Premier Gold Mining and Exploration Company, Limited, was incorporated on November 3, 1919, with a capitalization of \$2,000,000. The company has mining claims in lots 10 and 11, concession V, Beatty township, northeast of Matheson, and carried on work during the summer of 1920 with a force of 14 men in charge of James A. Burke. The property was formerly known as the "Hill."

The total underground work done on this property to date consists of a 200-foot incline shaft with levels at 100 and 200 feet, about 150 feet of drives on the 100-foot level and about 300 feet on the 200-foot level. The work done during the summer consisted of 200 feet of this lateral work, mostly on the 200-foot level.

The plant consists of a 40 and a 60 h. p. boiler, a 9-drill Ingersoll compressor and an 8-inch by 10-inch Jenekes hoist.

Work was stopped about September 1.

Kirkland Lake

Bidgood.—Bidgood Gold Mines, Limited, was incorporated March 26, 1919, with a capital of \$2,000,000 in \$1.00 shares, to work eight unpatented claims aggregating 234 acres in Lebel township. The officers are: George Tough, president; E. W. Kearney, secretary; C. E. Rogers, consulting engineer. The head office of the company is at 806 Ferry Street, Niagara Falls, Ont., and the mine office is at Haileybury, Ont.

Early in the year a power house, good camps to house 25 men, and a 35-foot head frame were erected. A 65 h. p. boiler, a 6-inch by 8-inch Jenckes hoist, and a four-drill Rand two-stage compressor were set up and shaft sinking was started under contract on April 22 by Dan Hughes. This contract covered the sinking of a two-compartment shaft to a depth of 316 feet and the driving of 775 feet of drifts and crossouts, mainly on the 300-foot level, to explore No. 4 and No. 9 veins. An average of 20 men was employed.

Some surface prospecting was also done on Nos. 2 and 3 veins to trace their extensions beyond the area previously trenched.

The work was stopped on November 3, 1920.

Fidelity.—Fidelity Mining and Development Company, Limited, incorporated May 14, 1917, with an authorized capital of \$2,000,000 in shares of \$1.00 par value, owns wholly or partly about 35 claims in the townships of Teek, Lebel, Morrisette, Turnbull, Grenfell, Alma, Catharine, and Skead. All assessment work has been completed except on three claims in Lebel and four in Catharine township.

During 1920 about 1,500 day's work, consisting of surface prospecting, was done by the company on its holdings in Lebel, Catharine, and Skead townships; the greater part of this was on a block of 12 claims in Skead at the north end of St. Anthony lake. Several promising veins were exposed and it is expected that further work will be done on these in 1921.

The most extensive work was done on mining claim L,2845 in Teek township where nothing had been done since the strike in 1919. Work was resumed in February, 1920, with a force of 20 men. After a sump was cut and 30 feet of drifting done on the 140-foot level, a contract was let to Church and Burton on April 30 and sinking began. On this contract, which was terminated on Dec. 30, 145 feet of shaft sinking was done, and 717 feet of driving done on the 300-foot level. In No. 325 drift on this level a considerable flow of water was encountered 100 feet northwest of the shaft; as continuous pumping failed to drain this, a dam was built and the drift diverted around and beyond the water-bearing zone. The best results were obtained in this No. 325 drift over a section about 70 feet long, beginning 70 feet northwest of the shaft and continuing to the face of the drift; these results were so encouraging that it is planned further to explore this area.

T. B. Tough is president of the company, and E. W. Kearney, Haileybury, is secretary.

Hunton-Kirkland.—Hunton-Kirkland Gold Mines, Limited, was incorporated on January 30, 1914, with a capital of \$1,500,000. The directors are: Thomas Birt, president; David Elliott, vice-president; Arthur Hunton; J. Walter Young; H. M. Porteous, manager. The company owns mining claims 16,620 and 16,621 comprising 80 acres and situated half a mile south of the Lake Shore mine in the township of Teek.

A power house and a residence for the manager were built, and a plant provided, consisting of a three-drill compressor driven by a 50 h. p. motor, and a 6-inch by 8 inch hoisting engine. A two-compartment shaft was sunk to a depth of 65 feet.

Kennedy Boston.—Kennedy Boston Gold Mines, Limited, was incorporated March 21, 1919, with an authorized capital of \$2,000,000 in \$1.00 shares to work the south half of lot 11, concession VI, Catharine township. The officers are: W. C. Kennedy, president; E. W. Kearney, secretary; Duncan Campbell, manager; C. E. Rodgers, consulting engineer. The head office is at Haileybury, Ont.

In 1920 the company carried on work intermittently during the first seven months of the year. Surface trenching was done, the two-compartment shaft sunk from 50 to 150 feet, and 250 feet of drifting and crosscutting done on the 150-foot level. In addition to this, some 200,000 feet of lumber was sawn on the property. From five to fifteen men were employed.

King-Kirkland.—The King-Kirkland Gold Mines, Limited, owns mining claims 8001, 4117, 4118, 2910, 2929, and L. 5108 in the township of Lebel. The directors are: C. F. Jordan, Toronto, president; E. L. Wettlaufer, Toronto, vice-president; A. B. Crosby, Toronto, treasurer; G. M. A. Davidson, Unionville, Ont., secretary; John Swartz, Kitchener, Ont., Major D. Sprague, Keswick, Ont.; Duncan McLellan, Brantford, Ont.

During the summer surface prospecting was done and comfortable office and camp buildings erected. During the winter a 6-inch by 8 inch hoisting engine and a 25 h. p. boiler were bought and a shaft 80 feet deep was sunk on the No. 5 vein.

Ernest Craig is superintendent.

Kirkland-Combined.—Kirkland-Combined Mines, Limited, was incorporated on May 28, 1917, with a capital of \$2,000,000. The property of the company is north of the Sylvanite mine.

The company began underground work in December, 1919, and ceased in 1920 after sinking a shaft to a depth of 200 feet and doing 110 feet of crosscutting on the 200-foot level.

A. W. Grierson was manager.

Kirkland Lake.—Kirkland Lake Gold Mining Co., Ltd. operated throughout the year. The mill treated 45,479 tons of ore and \$277,007.09 in gold was recovered. The development during the year was: drifting 1,500 feet, crosscutting 554 feet, raising 292 feet, sinking 115 feet, and station cutting, 233 cubic yards. No. 2 shaft has been continued from 700 to 900 feet in depth and a large electric pump installed on the 800-foot level. The drift on the 900-foot level is being extended under the central shaft, which is now 520 feet deep. This shaft will be continued to the 900-foot level.

The officers and directors are: F. L. Culver, president; William Thomas Mason, vice-president; R. Graham, secretary-treasurer; F. L. Lovelace and H. E. Tremain, directors. W. M. Sixt is mine superintendent.

Lake Shore.—The Lake Shore mine at Kirkland Lake worked continuously throughout 1920. This mine is owned by the Lake Shore Mines, Limited, which has an authorized capital of \$2,000,000 in shares of \$1.00 par value. The officers of the company are: Harry Oakes, president and managing director; Arthur G. Slaght, vice-president; W. H. Wright, 2nd vice-president; Dr. W. P. St. Charles, treasurer; Kirkland Securities, Limited, secretary; R. C. Coffey, mine manager. The directors are: Harry Oakes, Arthur G. Slaght, Dr. W. P. St. Charles, C. E. Wettlaufer, Albert Wende, J. B. Tyrrell, and Wm. H. Wright. From 90 to 100 men are employed.

The shaft has been continued from the 400 to the 600-foot level, where a station has been cut and crosscutting begun. The following summary of the underground work done in 1920 is taken from the manager's report:

SYNOPSIS OF DEVELOPMENT

	Feet advanced	Tons hoisted.	
		Waste	Ore.
Drifting.....	488	150	3,035
Raising.....	478		717
Shaft-sinking.....	164	2,143	
Stoping.....		99	15,574
Total.....	1,130	2,392	19,326

The 19,326 tons of ore hoisted came from the following sources:

	100 foot level	200 foot level	300 foot level	400 foot level
Drifting.....	18	577	501	1,939
Raising.....				717
Stoping.....	252	3,799	688	10,835
Total tons.....	270	4,376	1,189	13,491

The broken ore in the stopes amounts to 18,702 tons, having an average value of \$28.37 per ton, or a gross value of \$520,575.74, against which there are no deferred charges.

The 60-ton mill treated 18,889 tons of ore which yielded \$483,701.93 in bullion, an average recovery of \$25.61 per ton. From gross profit of \$234,992.59 two dividends amounting to \$80,000.00 were paid.

Lakeview.—The Lakeview Gold Mines, Limited, owns claims 6780, 6916, 6917, 6918, 8319, 8320, 8324, and 1825 in Maisonsville township.

During 1920 camps were built and a plant installed, in addition to considerable surface prospecting. The plant includes two 60-h. p. locomotive type boilers, a 5-drill compressor and a 7 by 10 hoist.

H. N. Darling was in charge of operations.

Lebel Oro.—The Lebel Oro Mines, Limited, capital \$1,500,000 in shares of \$1.00, owns mining claims 3066, 3067, 3191, 3411, and 3500, totalling 220 acres, in the township of Lebel. The head office of the company is in Room 8, Bank of Toronto Building, Toronto. The officers are: J. Bogert Bartram, president; W. R. Wadsworth, treasurer; Ralph Hurd, manager; and the directors are: J. Bogert Bartram, W. R. Wadsworth, Albert J. Bolton, William F. Greene, Walter E. Hurd, George A. Irwin, and William J. Yeoll.

After building a bunkhouse, a cookhouse, an office and a smithy in the summer, surface stripping and test pitting were done. Later a two-compartment shaft was started and had reached a depth of 30 feet at the beginning of February, 1921. From six to eight men were employed.

Ontario-Kirkland.—Ontario-Kirkland Gold Mines, Limited, was incorporated Sept. 18, 1917, with \$1,500,000 capital stock and has been working since on the Hurd claims, L. 2678 and L. 2679, in Teek township. The directors of the company are: Frank Huth, Nazareth, Pa., president; William H. Meyer, Philadelphia, Pa., vice-president; A. J. Bolton, Philadelphia, Pa., treasurer; Walter E. Hurd, Philadelphia, Pa.; William J. Yeocell, Philadelphia, Pa.; M. Y. Crauss, Palm, Pa.; W. A. Gordon, Haileybury, Ont., is secretary, and Ralph Hurd, Kirkland Lake, is manager.

In 1920 the shaft, which is on claim L. 2679, was continued from the 300 to the 450-foot level. About 2500 feet of drifting and crosscutting was done on the 300 and 450-foot levels. Some work was also done to prepare the foundation for a 100-ton mill. About 20 men were employed.



Shafthouse, Ontario-Kirkland Gold Mines, Ltd.

Orr.—The Orr, or Orr-Wettlaufer claim, No. T. 16,626 was worked from 1917 to June, 1920, by Kirkland-Porphry Gold Mines, Limited, under option. In 1920 it was worked from Aug. 4 to Dec. 10 by the Orr Gold Mines, Limited, of which the directors are: Conrad E. Wettlaufer, Buffalo, N. Y.; Hamilton B. Wills, Toronto; William J. Magavern, 54 Erie Savings Bank Building, Buffalo, N. Y.

The shaft on the claim is 420 feet deep; levels have been opened at 150, 238, 280, and, 400 feet, and considerable lateral work done. The progress in 1920 consisted of 284 feet of drifting on the 238-foot level and 270 feet of crosscutting on the 400 foot. Thirteen men were employed by the contractor, Victor Bush.

J. C. Houston is manager of the mine.

Teek-Hughes.—Teek-Hughes Gold Mines, Limited, operated the Teek-Hughes mine at Kirkland Lake continuously in 1920 and did 1,509 feet of development work.

The mill operated for 335 days and treated 30,646 tons of ore, which yielded \$247,757.04 worth of bullion.

D. L. H. Forbes is manager.

Wood-Kirkland.—Wood-Kirkland Gold Mines, Limited, was incorporated December 24, 1919, with \$2,000,000 of capital stock in shares of \$1.00 par value. The company owns mining claims L. 6406, L. 7127, L. 7477, L. 7478, and L. 7479, in all 296 acres, situated south of Mud lake in the township of Lebel. The di-

rectors are: George W. Morris, Buffalo, N. Y., president; N. W. Kirkpatrick Dayton, Ohio, vice-president; Fred C. Bonnet, Hamburg, N. Y., treasurer; Henry J. Wood, Buffalo; James E. Day, Toronto; E. L. Wettlaufer, Toronto; A. L. Pfan Terrehaute, Ind.

Work was started in March, 1920, and an office and camps to house 25 men were built. A two-compartment shaft was sunk to a depth of 100 feet and a small amount of drifting done. The machinery consists of a 20 h. p. boiler and a small hoisting engine.

E. B. Wood, Haileybury, is manager, and J. A. Murphy is superintendent. From 10 to 15 men were employed.

Wright-Hargreaves.—Wright-Hargreaves Mines, Limited, was incorporated on June 16, 1916, to work four claims at the east end of Kirkland lake—L. 2103, L. 1829, L. 1830, and L. 1831 (survey numbers,—T. C. 710, T. C. 709, T. C. 708, and T. C. 711, respectively). The officers of the company are: Oliver Cabana, Jr., president; Edwin Lang Miller, vice-president; Gerard F. Miller, secretary-treasurer; Albert Wende, manager; James E. Grant, superintendent. The executive office of the company is at 375-377 Ellicott Square, Buffalo, N. Y.



Wright-Hargreaves Mines, Ltd., showing new mill.

The company re-opened the mine in the spring of 1920 and did the following work: sank No. 1 shaft from a depth of 40 to 400 feet; enlarged No. 3 shaft from two to three compartments from the 300-foot level to the surface; on the 300-foot level did 110 feet of drifting; on the 400-foot level did 175 feet of drifting and 110 feet of cross cutting, the latter work being to connect the No. 3 shaft workings with the bottom of the No. 1 shaft.

A 150-ton mill is nearing completion and is expected to be in operation in the spring of 1921.

Larder Lake

Argonaut.—Argonaut Gold, Limited, continued to operate the Argonaut mine formerly known as La Mine D'Or Huronia, in Gauthier township until near the end of the year. The officers of the company now are: J. H. Rainville, president; D. Raymond, vice-president; L. J. Marchand, secretary-treasurer; J. W. Morrison, general superintendent. The capital stock consists of 3,000,000 shares of \$1.00 par value, of which 800,000 are retained in the treasury. The head office is at 601 Royal Trust Building, Montreal.

The following machinery was added to the plant in 1920: a duplex air compressor with a capacity of 732 cubic feet driven by a 100 h. p. motor, a 75 h. p. electrically driven hoisting engine, and an 18-inch by 24-inch Blake jaw crusher.

The shaft was continued from a depth of 179 feet to 380 feet and levels were established at 200 and 350 feet. There were also 851 feet of drifting and 415 feet of crosscutting done.

The mill treated 4,637 tons of ore, of which 1,958 tons came from stopes and the remainder from the development openings. The yield was about \$30,000.

The mill closed on October 22, and the mine on December 23.]

Associated Goldfields.—Associated Goldfields Mining Company, Limited, has a capitalization of \$5,000,000 in \$1.00 shares. Of the 4,991,724 shares that have been allotted, 4,257,977 shares are held by Canadian Associated Goldfields, Limited. The latter company was granted letters patent on August 7, 1920, and has an authorized capital of \$30,000,000 in \$1.00 shares, of which 18,136,294 shares have been subscribed for and allotted. The officers and directors are the same for both companies and are as follows:— president, Dr. George A. MacKay, Toronto; secretary and treasurer, R. William MacKay, Toronto; directors: Dr. George A. MacKay, A. A. McFall, A. Singer, S. B. Gundy, W. H. Despard, all of Toronto; D. H. McCartney, Milton, Ont.; J. Dinwoody, Islington, Ont. The offices are at 306 C. P. R. Building, Toronto.

During the early part of 1920 two rock drills and one diamond drill were at work in the Reddick mine ("Block D"). During the summer only diamond drilling and sampling were being done here.

At the Kerr-Addison property ("Block C") a three-compartment shaft was started on October 4 and was down 70 feet at the end of the year.

At the Harris-Maxwell ("Block B") from two to three drills were operated continuously on the 400-foot and 500-foot levels, and some diamond-drilling was also done.

The combined working forces at the first two properties numbered from 25 to 30 men; at the Harris-Maxwell from 60 to 70 men were employed, and in addition 10 or 15 men were engaged in winter in the logging camp.

A. J. Moore is mine manager. All the above properties are at Larder Lake.

Crawford Skead.—Crawford Skead Gold Mines, Limited, head office at Chatham, Ont., was incorporated on December 5, 1919, with a capital of \$1,000,000. The company owns two claims in lots 9 and 10, concession V, Skead township, adjoining the Wisconsin-Skead mine on the southwest. A small force was employed at surface work and the building of camps.

Peerless.—The Peerless Gold Mines, Limited, carried on work on their property in McElroy township during most of the year.

During the first half of the year the shaft was continued from a depth of 132 feet to 250 feet, and 400 feet of drifting was done on the 400-foot. The working force during that period averaged about 35 men and was in charge of superintendent A. D. McPhee. After a shut-down of a month 20 men were put to work under John McDonald as superintendent, and an incline shaft was sunk on No. 3 vein to a depth of 100 feet.

On November 30, 1920, the company went into liquidation, and all work was stopped.

Skead.—Skead Gold Mines, Limited, was incorporated on October 9, 1919, with an authorized capital of \$5,000,000 in shares of \$1.00 par value. The company has acquired 55 mining claims, the two main groups being in lots 2 to 8 in the fourth concession of Skead township. Work was started in the spring of 1920 on these two groups, which are in the vicinity of St. Anthony lake in Skead township; about 20 men were employed.

On the group of claims east of St. Anthony lake a camp to house 40 men, a storehouse, an office, and a boathouse were built. Eight test pits were sunk to an average depth of about ten feet, about 4,000 cubic yards of soil removed in trenching and stripping.

The officers of the company are: Dalton McCarthy Gilpin, president; Louis C. Park, vice-president; James Brebner, treasurer; H. J. Bolitho, secretary; all of Toronto. C. William Evans is manager, and M. L. Bouzan, superintendent.

Wisconsin-Skead.—Wisconsin-Skead Mines, Limited, incorporated August 27 1917 with \$2,000,000 capitalization, has property in lot 10, concession V, and lot 10, concession VI, Skead township.

Work was resumed on May 4 and was continued for three months with a force of 20 men.

The company's office is at Ashland, Wis. William Reinhardt is mine manager.

Porcupine

Beaumont.—The Beaumont Gold Mines, Limited, capital \$2,000,000 in shares of \$1.00 par value, owns mining claims 12,765, 12,868, and 6,039 in lots 2 and 3, concession VI, Tisdale township. The last-mentioned claim was formerly known as the North Davidson mine. The officers of the company are: R. T. Jeffrey, president; L. K. File, vice-president; L. G. Harris, secretary and general manager. The head office is at 601 Royal Bank Building, Toronto.

The following buildings were erected: power house, 30 feet by 24 feet; two-story office, 22 feet by 24 feet; two-story bunk house, 24 feet by 30 feet; dining camp, 24 feet by 30 feet; smithy 18 feet by 26 feet; and change house, 12 feet by 14 feet. Preparatory to letting a contract for sinking a shaft, a 40 h. p. and an 85 h. p. boiler, a four-drill Rand duplex cross-compound air compressor, and an 8-inch by 10-inch hoisting engine were provided.

Sinking was started on May 1, 1920 and the shaft was 54 feet deep in October

Clifton-Porcupine.—Clifton Porcupine Mines, Limited, was incorporated on April 5, 1919, with a capitalization of \$2,000,000 in shares of \$1.00 par value, to work a 40-acre property in Deloro township. The directors are: F. C. Preston, Midland, Ont., president; Homer L. Gibson, Toronto, vice-president; James Cowan, Toronto; W. E. Preston, Midland, Ont.; W. C. Offer, South Porcupine, Ont. The head office is at 703 Bank of Hamilton Building, Toronto.

This company continued to work during the first half of 1920 and had 20 men employed. After deepening the incline shaft to 228 feet, a small amount of drifting was done on the second, or 196-foot level.

Davidson.—Davidson Consolidated Gold Mines, Limited, was incorporated on July 15, 1919, with a capitalization of \$5,000,000. The new company took over the assets of Davidson Gold Mines, Limited, and continued to work the Davidson mine for the first five months of 1920. The officers are: C. G. Crean, president; H. H. Sutherland, vice-president and managing director; L. C. Platt, secretary-treasurer; N. J. Evered, South Porcupine, Ont., manager.

Development work done consisted of 380 feet of drifting and 316 feet of cross-cutting; 346 feet of the drifting and 271 feet of the crosscutting were done on the 500-foot level. A total of 1,188 feet of diamond drill holes

In the five months the mill treated 3,003 tons of ore from which the recovery was \$11,210.30.

Dome.—The Dome Mines Company, Limited, has an authorized capital of \$5,000,000 in shares of \$10.00 par value. Of this stock \$4,706,110 has been issued, \$60,560 has been allotted, but is not yet issued, and \$233,330 remains in the treasury. The increase of \$766,670 in the amount of stock issued was occasioned by the purchase of the Dome Extension property in September.

The executive officers of the company are: J. S. Bache, New York, president and treasurer; W. S. Edwards, Chicago, vice-president; H. P. DePencier, South Porcupine, Ont., vice-president and general manager; Alex Fasken, Toronto, secretary; Alfred H. Curtis, New York, asst. treasurer and asst. secretary. The directors are as follows: J. S. Bache, New York; W. S. Edwards, Chicago; Alex. Fasken, Toronto; G. C. Miller, Buffalo, N.Y.; A. H. Curtis, New York; Colgate Hoyt, New York; T. R. Finucane, Rochester, N. Y.; C. D. Kaeding, South Porcupine, Ont.; Howard Poillon, New York. The head office is at 36 Toronto St., Toronto, and the executive and financial office at 42 Broadway, New York. The fiscal year of the company ends on March 31.

The net excess of current assets over current liabilities now amounts to \$1,539,161.27.

The option to purchase the Dome Extension property was exercised by the Dome Mines Company, Limited, and this action was ratified unanimously by the Dome shareholders at a meeting held on September 4, 1920.

Four dividends of $2\frac{1}{2}$ per cent were paid during the year: Nos. 10 and 11, \$100,000.00 each, and Nos. 12 and 13, \$119,166.75 each, making a total distribution of \$438,333.50.

The following information is summarized from the annual report of general manager DePencier:

The operating account for the year ending March 31, 1921, shows:

Revenue from bullion,.....	\$ 1,946,403 06
Expenditures	
Mining, including hoisting.....	\$ 343,774 40
Development.....	\$ 253,167 97
Crushing and conveying.....	\$ 58,641 08
Milling.....	\$ 427,723 72
Administration expense, general and executive offices.....	\$ 120,061 67
Provincial and municipal taxes.....	\$ 14,341 16
Insurance.....	\$ 21,798 69
Total operating costs.....	\$ 1,239,508 69
Net operating earnings.....	\$ 706,894 37

The net profit for the year was \$302,479.89.

Development and Mining.—During the year a total of 289,789 tons of ore and rock were hoisted; of this 273,700 were ore which was sent to the mill and treated; and 16,089 tons were waste; of the ore milled, 257,657 tons came from the stopes and averaged \$7.58 per ton, and 16,043 tons came from development and averaged \$6.30 per ton. No ore was drawn from the Dome Extension mine during the year.

Stoping and development have been carried on at the 5th, 6th, 7th, 8th and 10th levels. The shortage of labour and power again necessitated drawing on the broken ore reserve to the extent of about 50,000 tons. The broken ore reserve now stands at a little over 200,000 tons.

The most important development work of the year has been done at the 10th level. Here, during the first six months of the year, an endeavour was made to locate sufficient ore to warrant the exercising of the Dome Extension option, and, on account of the shortage of underground labour, the work had to be carried on mainly by diamond drilling. This drilling indicated an orebody to which the number 1012 has been given; this body dips north and rakes eastward into the Dome Extension. Further drilling showed that another orebody lies to the south of the former one; this is called the 1020 orebody. The shortage of labour prevented the opening up of these bodies until the latter months of the year.

The 1012 orebody has been opened up for a length of 360 feet. The ore closely resembles the ore in the large hanging wall orebodies of the Dome and consists of a mixture of well mineralized schist and small quartz veins and veinlets. These veins of quartz are irregularly distributed and are not continuous. Some of them roughly conform to the dip and strike of the orebody; others lie at angles and penetrate the walls of the main orebody. The walls are not well-defined and, owing to the presence of these cross veins and bunches of mineralized schist, will only be determined by the gold content of the rock. In addition to very rich pyrite, there is some visible gold present. The rich pyrite is well crystallized, fine, and loosely held in the schist. These facts, together with the presence of visible gold, render the sampling of these drifts difficult and unreliable. For example, the moil sampling of the 360 feet of the 1012 orebody drift, including all high assays, shows an average of \$26.00; this does not represent the average grade of ore that can be expected to be mined from this orebody for the reasons mentioned above, namely, the presence of visible gold, the loosely held rich pyrite, and also for the reason that the drift is in the footwall portion of the orebody, which is known to be the richer; further, the presence of bunches of mineralized schist and small cross veins of quartz beyond the margin of the main oreshoot will undoubtedly lead to dilution in mining. A small stope sill has been cut out at the eastern end of the 1012 orebody, and from the results obtained in this work a grade of from \$10 to \$12 per ton is anticipated for this orebody. The width disclosed in this sill is about 22 feet on an average.

The 1020 orebody lies 80 feet south of the 1012, has approximately the same strike and dip, but is more irregular in mineral content. There is some pyrite and copper mineral present. It contains visible gold and the moil sampling is unreliable. It is expected that ore of good payable grade will be mined here. This orebody has been drifted in for 110 feet.

In addition, on the 10th level, the ore and waste pockets have been cut and put in use, a small pump chamber and sump have also been completed, and a three-throw pump installed which lifts to the main pumping plant at the 8th level.

The development work for the year 1920-1921 is summarized below :

SUMMARY OF DEVELOPMENT WORK FOR YEAR 1920-1921.

Level	Drifts	Cross Cuts	Raises	Box Holes	Miscellaneous	Pockets	Total	Diamond Drilling
Dome Mines								
5th.....	162	541	153	72	.....	.....	928	.....
6th.....	.....	122	150	29	.....	.....	301	350.00
7th.....	283	152	414	213	.....	.....	1,062	1,182.20
8th.....	339	608	560	135	8	.....	1,650	4,307.50
10th.....	713	1,010	32	101	57	53	1,966	3,865.26
	1,497	2,433	1,309	550	65	53	5,907	9,704.96
Dome Extension								
6th.....	6	60	10	.....	.....	.....	76	575.5
10th.....	.....	9	8	.....	.....	.....	17	3,488.3
	6	69	18	.....	.....	.....	93	4,063.8
Totals.....	1,503	2,502	1,327	550	65	53	6,000	13,768.76

Waste hoisted, 16,089 tons.

Dome Extension Development:—At the 6th level only a small amount of crosscutting and diamond drilling was done in the ore zone during the past year under the terms of the option held by the Dome. This diamond drilling gave results of the same general character as those reported for this territory in last year's report. The work done to date has shown the existence of a large amount of low grade ore from which a profit can only be won under normal operating conditions as regards costs. The work done at the 10th level proves that the ore-bearing formations extend into the Dome Extension.

Ore Reserves:—In the 9th annual report of the company, covering the year 1919-1920, the following remarks regarding ore reserves appeared:

"Experience with stoping and developing the orebodies in the Dome has demonstrated conclusively the futility of attempting to accurately estimate their tonnage and value in the conventional manner on account of the irregularity of their form, and the extremely erratic distribution of gold in them. For the past seven years an earnest effort has been made to make these estimates and an immense amount of engineering data has been accumulated and worked up each year, but in the final analysis an intimate knowledge of the mine, together with the figures for the past actual performance of ore-bearing zones, and the condition of existing exposures of ore have to be more heavily drawn upon than the accurately assembled sampling and surveying data.

"We feel, therefore, that a sounder forecast of the future life and earning power of the property can be given by not attempting to be specific in the matter of ore tonnage and value, but that we should confine ourselves to a broad statement based on a wide review of all the data available. We propose, therefore, to confine ourselves to stating that your property contains ore reserves at the present time sufficient to enable us to continue operating at the full capacity of your plant for a period of three to four years."

On this subject the 10th annual report of the company says:

"The futility of endeavouring to accurately estimate the tonnage and value of ore bodies in the Dome in the conventional manner was dwelt upon in last year's report, and our experience during the past year fully confirms the views laid down at that time. From our knowledge and experience of the mine it is our belief that the limited amount of development work, which under the conditions it has been possible to accomplish, has exposed ore equivalent in value to that milled during the past year. In this connection we regard the developments on the 10th level of extreme importance, as they prove the occurrence of highly-payable ore at the lowest level opened up, and under normal operating conditions ensure the maintenance of the earning power of the mine at a figure comparable with past performance.

"It is hoped that further development of the orebodies intersected in our deeper levels may prove them to be more regular in form and gold content than those in the upper workings, and that, therefore, it will be possible to estimate their value more definitely."

Mill:—The following are the treatment results from the operation of the mill during the year:

		Per Ton	Per Cent.
Heads, 273,700 tons.....		\$7.507	.....
Amalgamation Bullion.....	\$1,221,875.88	4.464	59.467
Cyanidation Bullion.....	724,527.18	2.647	35.261
Total Recovery.....	\$1,946,403.06	\$7.111	94.728

The total expenditure in milling was \$427,723.72 or \$1.563 per ton milled. This compares with a cost of \$1.153 per ton milled during the previous year, the increase being due to increased wage rates, cost of supplies and the greatly increased cost of power during more than three months of the year when we had to operate our steam plant.

During the year, improvements have been made in our grinding equipment which will result in an improved recovery. The recovery for the past year was 94.728% as compared with 94.295% a year ago. Two additional Pachuca tanks have been erected at a cost of \$16,837.89 in an extension built for the purpose and will be put into operation in April. These additional agitators together with improvements in the grinding mill, it is expected, enable us to maintain our recovery when treating a greater tonnage of the higher grade and probably somewhat more refractory ore from the deeper levels of the mine, at the figure which was established on the lower grade ore for which the Mill was planned when the extensions were made some years ago.

General:—Operating costs show an increase of \$1.08 per ton milled over last year, thus reflecting the conditions under which we have been compelled to operate. They also include an increased charge of 92.5c. per ton milled for development as against 52c. last year.

During the year an increase of about 50c. per shift was granted to employees in an endeavor to attract more labor. Also the 8-hour day was inaugurated in all departments. Another large dormitory building, capable of housing over 100 men, was erected at a cost of \$35,966.16. A new hospital building, to replace the old one which was destroyed by fire, is nearing completion. The loss was fully covered by insurance.

Practically throughout the year, the cost of materials used in our business has remained at very high figures, this being due in part to the high freight rates in effect. It is only recently that prices have begun to fall materially.

The shortage of power which developed in November, took us entirely by surprise, as we had always been given to understand that there was ample water storage to tide over any dry season. At present, we are receiving sufficient power for our operations, and we are assured by the power company that such steps will be taken this summer as will assure a more adequate water supply in the future.

An ample supply of labour for our operations is now available.

Dome Lake.—The Dome Lake Mining and Milling Company, Limited, worked the Dome Lake mine at Porcupine for the first five months of the year. The company is capitalized at \$3,000,000, divided into shares of \$1.00 par value and has its head office at New Liskeard, Ont. The officers are: A. A. McKelvie, president; Wm. H. Kinch, vice-president; F. L. Hutchinson, secretary-treasurer.

There were driven during the five months 70 feet of drifts and 39 feet of crosscuts, all on the 600-foot level on vein No. 3. This makes the lateral work done to date in this mine 10,833 feet of drifting and 4,326 feet of crosscutting.

All ore broken was milled before the mine was shut down; this amounted to 5,336 tons, of which 2,234 tons were on hand on January 1, 1920. The ore treated had an average value of \$9.73 per ton, or a total value of \$51,919.28. From it were obtained 2,264.4 ounces of fine gold and 334.2 ounces of fine silver, for which the company received \$47,023.69. The extraction, therefore, was 90.5%, a great improvement over that of the previous year. The mining costs were \$29,678.14, and the milling costs \$16,270.00.

D. M. McPhail was manager, and 45 men were employed.

Hollinger.—Hollinger Consolidated Gold Mines, Limited, has an authorized capital of \$25,000,000. On January 1, 1921, there were outstanding 4,920,000 shares of \$5.00 par value. The directors of the company are: president, Noah A. Timmins, Montreal; vice-president and treasurer, David A. Dunlap, Toronto; secretary, John B. Holden, Toronto; L. H. Timmins, Jules R. Timmins, Dr. Wilfred L. McDougald, all of Montreal. The general manager is A. F. Brigham, Timmins, Ont. The general office of the company is at 85 Bay Street, Toronto, and the head office is at Timmins.

The general manager's report for the year ending December 31, 1920, shows a total income of \$7,162,611.13; of this amount the bullion produced yielded \$6,939,628.43 and other sources \$222,982.70. Working expenses absorbed \$3,144,328.73, taxes \$225,940.81, depreciation and donations \$1,343,007.47, leaving a net profit of \$2,675,274.93. Nine dividends of one per cent each, amounting in all to \$2,214,000.00, were paid during the year, and the sum of \$461,274.93 was added to the surplus, which now amounts to \$3,131,852.01.

The new hospital was completed during the year. Including the equipment, the total cost was \$103,212.15. This building is modern in every detail, and was designed to accommodate 35 patients, including maternity cases.

The money advanced to the Hollinger Stores, Limited, for the purchase and operation of the stores was transferred to capital assets and written down to \$40,002.

Marked decreases in the labour supply and the consequent low tonnage necessitated the milling of a better grade of ore, than would otherwise have been handled. The net yield was \$9.56 per ton, as compared with \$9.40 for 1919.

Power shortage since the autumn has caused considerable curtailment of production and the operation of the auxiliary steam plant will add materially to the cost of operations during the winter months. The capacity of the company's connected apparatus is about 7,500 k. w., and the power company was able to supply only 1,700 k.w. during the winter.

The following information taken from the report summarizes the result of the years' operations:

COST DATA

Sundries	Labour	Stores	Total	Per Ton of Ore
Total General Charges..... \$79,633.52	\$182,417.08	\$80,083.07	\$342,133.67	\$0.5262
Total Mining Charges.....	1,192,326.14	658,720.78	1,851,046.92	2.8469
Total Milling Charges.....	335,401.24	615,746.90	951,148.14	1.4628
Grand Total..... \$79,633.52	\$1,710,144.46	\$1,354,550.75	\$3,144,328.73	\$4.8359



Underground haulage, Hollinger mine, showing electric trolley locomotive drawing a train of ore cars.

ORE RESERVES

A complete recalculation of the tonnages and values of all veins, based upon new and more accurate data, discloses material improvement in the gold content. Labour shortage has resulted in confining our efforts to the development of the better grades of ore.

Increases in wages and the continued high prices of mining supplies have determined the policy of deleting all ore of \$6.00 or less per ton. The tonnage formerly reported in the statement of surface outcrops is similarly treated. This does not mean that we consider them valueless, but, keeping in mind the present disabilities under which gold mining is being carried on, we feel that these items should not be included in a conservative statement.

	Tons	Value per ton	Estimated gross value Dec. 31, 1920.	Estimated gross value Dec. 31, 1919.
TOTAL ORE RESERVES, (DEVELOPED UNDERGROUND).				
Above 425-foot level.....	1,433,409	\$10. 71	\$15,354,779	.....
Above 800-foot level:.....	1,629,753	11. 61	18,933,784	.....
Below 800-foot level.....	230,843	9. 99	2,307,496	.....
	3,294,005	11. 11	36, 596,059	\$37,693,450
PROBABLE ORE.				
Veins under \$6.00.....	585,078	5. 36	3,135,731	157,200
Surface outcrops.....	208,000	9. 55	1,987,880	2,077,780
Grand total.....	4,087,083	10. 20	\$41,719,670	\$39,928,430



Diamond drill, Hollinger mine. Note the character of the ore body.

Another summary of the ore reserves developed underground shows the same total as above but the classification is different:—

	Tons	Value per ton	Estimated gross value Dec. 31, 1920	Estimated gross value Dec. 31, 1919
Veins over \$10.00.....	1,394,453	\$14.02	\$19,547,832	\$18,291,480
Veins \$10.00 to \$8.00.....	1,748,456	9.09	15,904,110	18,099,650
Veins \$8.00 to \$6.00.....	151,096	7.57	1,144,117	1,302,320
Totals.....	3,294,005	\$11.11	\$36,596,059	\$37,693,450

OPERATIONS IN PLANT AND DEVELOPMENT ACCOUNTS

Showing expenditures by companies now comprised in Hollinger Consolidated Gold Mines, Ltd.

Year	Plant		Development	
	Expended	Written off	Expended	Written off
1910-1915	\$1,839,910.05	\$529,480.89	\$1,155,644.67	\$379,346.37
1916	599,417.16	150,000.00	125,593.32	
1917	673,237.52	100,000.00	131,224.23	
1918	118,379.14	375,000.00	5,006.54	
1919	338,162.32	600,000.00		629,872.39
1920	131,359.78	445,985.08		408,250.00
Totals	\$3,700,465.97	\$2,200,465.97	\$1,417,468.76	\$1,417,468.76

The present valuation of \$1,500,000.00 for plant is 40.5 per cent. of the total cost.

EMPLOYEES

Average number of men during the year has been 1,025, distributed as follows:

Miners		Mechanics		General		Totals	
Exploration.....	11	Operation.....	49	Mill & Refinery.	136	Miners.....	629
Development....	138	Maintenance...	80	Engineering		Mechanics.....	138
Production.....	480	Construction...	9	Staff.....	29	General.....	258
				Clerical Staff...	24		
				Miscellaneous..	69		
	629		138		258		1,025

MILLING RESULTS

Tons Ore Milled.....	650,205
Average Value Per Ton.....	\$ 9 93
Gross Value.....	\$ 6,456,623 28
1,156 Tons Old Concentrates.....	\$ 9,708 52
Total Gross Value.....	\$ 6,466,331 80
Deduct Loss in Tailings.....	246,667 00
Net Value Recovered.....	\$6,219,664 80

Average tons per day.....	1,777	Cyanide consumed per ton of ore...	0.532 lbs.
Per cent. of possible time run.....	53.8	Zinc consumed per ton of ore.....	0.449 lbs.
Tons per 24 hours running time.....	3.303	Zinc consumed per ton of solution..	0.178 lbs.
Stamp duty per 24 hours running time.....	14.68	Lime consumed per ton of ore.....	2.871 lbs.
Tons solution precipitated per ton ore.	2.52	Lead acetate per ton of ore.....	0.034 lbs.
Value per ton in tailings.....	\$0.38	Average value pregnant solution...	\$3.80

MINE DEVELOPMENT

Progress during the year was as follows:

Level	Shafts	Drifts	Cross Cuts	Raises	Diamond Drilling	Timbering		Excavation
						Shafts	Stopes	
	feet	feet	feet	feet	feet	feet	feet	tons
100 feet				121	4,250			
200 feet		907	245	8	2,710		497	452
300 feet		1,693	468	79	6,923		77	210
425 feet		909	342	21	5,202		571	420
550 feet		2,655	2,601		8,117		2,796	390
675 feet		1,622	3,099		2,788		23	185
800 feet		1,280	1,129	20	9,603		396	
950 feet			276					
1,100 feet			326					145
1,250 feet	5					20		410
1,450 feet	150					150		535
1,550 feet	147				602	132		
Totals	302	9,066	8,486	249	40,195	302	4,360	2,747

Total Sinking, Drifting, Cross-Cutting and Raising: 18,103 feet.



Hospital at Timmins, erected in 1920 by the Hollinger Consolidated Mines, Ltd.

MINE PRODUCTION

Level	Broken Ore in Mine Jan. 1, 1920	Ore Broken During 1920	Ore Removed During 1920	Broken Ore in Mine Dec. 31, 1920
No. 10 Shaft Dump.	2,250			2,250
No. 11 Shaft Dump.	1,490		1,490	
Above 100 ft. Level.	895	5,292	6,187	
“ 200 ft. Level.	65,620	126,074	135,598	56,096
“ 300 ft. Level.	37,404	86,483	89,623	34,264
“ 425 ft. Level.	162,799	69,655	154,738	77,716
“ 550 ft. Level.	76,018	378,618	221,728	232,908
“ 675 ft. Level.		23,818	23,158	660
“ 800 ft. Level.	480	15,966	16,355	91
“ 950 ft. Level.		91	91	
“ 1,100 ft. Level.		45	45	
Totals.	346,956	706,012	649,013	403,985



Fault, No. 91 vein, 425-ft. level, Hollinger mine.

Keora.—Porcupine Keora Mining Company, Limited, was incorporated on April 6, 1911, with a capitalization of \$2,000,000 to work four claims in lot 6 and one in lot 5 of the fifth concession of Whitney township. The officers of the company now are: W. B. Gunton, Confederation Life Building, Toronto, president; William Smith, secretary-treasurer; J. C. Waite, manager.

During 1920 the main shaft was sunk from a depth of 120 feet to 250 feet, and a crosscut was started. This crosscut entered the vein at 465 feet from the shaft about the end of January, 1921.

McIntyre.—McIntyre Porcupine Mines, Limited, with mines and mill at Schumacher, Ont., has an authorized capitalization of \$4,000,000; this is divided into shares of \$1.00 par value, of which 3,640,283 shares have been issued. The officers of the company are: president, J. P. Bickell, Toronto; vice-president, Henry M. Pellatt, Toronto; secretary-treasurer, M. P. Van der Voort, Toronto; assistant-secretary, L. J. Pashler, Toronto; general manager, R. J. Ennis, Schumacher, Ont.; mine superintendent, J. E. McAllister, Schumacher, Ont.; mill superintendent, A. Dorfman, Schumacher, Ont. The board of directors consists of: the president; the vice-president; W. J. Sheppard, Waubaushe, Ont.; J. B. Tudhope, M. P., Orillia, Ont.; N. S. Dunlop, Montreal. The head office is in the Standard Bank Building, Toronto.

The following information is taken from the eighth annual report of the company, which covers the fiscal year ending June 30, 1920:

Net operating earnings amounted to \$1,051,404.13 and non-operating earnings to \$228,828.24, making a total of \$1,280,232.37 earned during the year as compared with \$839,588.62 during the previous year. Of this amount \$462,211.54 was appropriated as follows:—

Plant depreciation.....	\$180,213.76
Written off securities to bring these to present market price.....	25,000.00
Expenditures for development work and interests acquired in adjoining properties.....	204,427.80
Amount reserved for taxes accrued for the current year.....	52,569.98

This left a net profit of \$818,020.83.

During the year three dividends of five per cent each, aggregating \$546,042.45, were paid to shareholders. Surplus at June 30, 1920, amounted to \$1,381,683.98.

The production since the commencement of milling operations in 1912 is tabulated below:

Date	Period	Tons Milled	Value Per Ton	Gross Value	Recovery	
					Per Ton	Total
1912.....	12 Months	14,500	\$ 7.00	\$ 101,555.16	\$5.25	\$ 76,166.38
1913.....	12 Months	31,979	7.85	251,314.45	7.05	225,752.25
Jan. 1-14 to Mar. 31-15....	15 Months	85,654	8.87	760,232.16	8.39	718,331.71
April 1-15 to Mar. 31-16....	12 Months	105,758	7.71	815,345.49	7.38	779,990.94
April 1-16 to June 30-17....	15 Months	195,307	10.00	1,954,793.28	9.55	1,864,914.28
July 1-17 to June 30-18....	12 Months	178,327	10.05	1,793,197.55	9.61	1,714,258.00
July 1-18 to June 30-19....	12 Months	179,874	9.78	1,759,627.40	9.29	1,671,646.03
July 1-19 to June 30-20....	12 Months	188,835	11.52	2,175,891.31	11.02	2,080,188.44
		980,234	\$9.80	\$9,611,956.80	\$9.32	\$9,131,248.03

The bullion recovered during the year contained 99,461.39 ounces of gold and 21,140.3 ounces of silver and was valued at \$2,080,188.44, or \$11.02 per ton of ore treated.

A total of 262,512 tons of ore was mined in the No. 5 and Main shaft workings, and 190,403 tons of this was hoisted, 72,109 tons remaining broken in the stope. No ore was mined in the Jupiter workings, but the shaft was used during the first four months of the year to explore the Plenaurum property from the 1000-foot level.

SUMMARY OF ORE HOISTED.

Level	Tons	Assay	Value
600.....	7,742	\$ 6.85	\$ 52,846.00
700.....	2,929	9.30	27,207.00
800.....	33,986	13.25	450,335.00
900-1,000.....	63,883	10.02	640,524.00
1,125.....	77,705	12.09	939,380.00
1,250.....	2,335	13.60	31,745.00
1,375.....	1,115	10.40	11,594.00
1,500.....	138	9.90	1,368.00
Shaft.....	570	12.55	7,147.00
	190,403	11.55	\$2,162,146.00

DEVELOPMENT AND EXPLORATION

The limited number of workmen available for development work have been employed in opening up the 1125, 1250 and 1375-foot levels. The Main shaft was put down from 1400 to 1560 feet and levels cut at 1250, 1375 and 1560 feet. Ore and waste pockets were cut at 1375 and loading boxes installed. An ore pass was raised through to the 1250 and is being continued to the 1125; when it is completed, all the ore from these levels will drop directly to the ore pocket on the 1375-foot level.

At 1490 feet the main shaft encountered an ore body and continued in it for 50 feet; this ore body was exposed in the station on the 1500-foot level and is 12 feet wide, assaying \$10.20. The 1500-foot station also crosscut No. 5 vein 50 feet south of the shaft; this shows 10 feet of ore assaying \$13.00.

For some time the important influence of the quartz porphyry upon the ore bodies found in the Pearl lake section has been recognized, and it has been considered as highly probable that new ore bodies would be found below the 1000-foot horizon. Accordingly diamond drilling was carried from each new level to obtain geological data and to prospect the mineralized area on the north contact. The results have finally been successful and a drill hole bearing S. 20 degrees W. at an angle of 15 degrees downward from the 1500-foot level intersected an ore body 530 feet from the main shaft at a depth of 1610 feet from the surface; 35 feet of core assayed \$11.10. A hole was then drilled from the 1375-foot level at an angle of 5 degrees and with a bearing S. 20 degrees E.; at 480 feet this hole intersected the same ore body at a depth of 1385 feet from the surface and 26 feet of the core assayed \$14.10. Crosscuts are now being driven south from the 1375 and 1500-foot levels to open up this new ore body.

SUMMARY OF DEVELOPMENT AND EXPLORATION WORK

	Drifts feet	Cross- Cuts feet	Raises feet	Win- zes feet	Shafts feet	Stations feet	Sump tons	Pockets tons	Footage Total	Total Tons Excav.	Diam- ond Drilling
July 1, 1919 to June 30 1920.....	3,196.7	372.0	765.0	.....	298.0	177.0	.....	2,136.0	4,808.7	2,136.0	4,538.0
Prior to June 30, 1919.	32,045.1	13,414.3	5,412.4	579.7	5,342.1	1,171.0	2,402	1,100.0	57,964.6	3,592.0	36,317.6
Total to June 30, 1920.	35,241.8	13,786.3	6,177.4	579.7	5,640.1	1,348.0	2,402	3,236.0	62,773.3	5,638.0	40,855.6

OPERATING COSTS

The total operating costs per ton milled amounted to \$5.4844. Mining costs totalled \$3.0557 and are made up of: breaking and stoping \$2.2421, development \$0.7715, and exploration \$0.0421. The more important of the remaining items are: milling \$1.0449; head office expense \$0.3369; mine office expense \$0.2777; heating and maintenance—buildings and camps \$0.2334; crushing and transportation of ore \$0.2273. Operating costs show an increase of 40c. per ton over last year, mainly caused by an increase in the cost of labour.

ESTIMATED ORE RESERVES

In the following estimate of ore reserves ample allowance has been made for the reduction of values due to barren schist inclusions in the vein and dilution of broken ore by wall rock.

	Tons	Assay	Amount
Jupiter claim.....	35,295	\$ 7.45	\$ 262,947.75
McIntyre and Pearl Lake claims.....	353,876	11.30	3,998,798.80
Broken ore reserves in stopes.....	113,511	11.75	1,333,754.25
TOTALS.....	502,682	11.13	\$5,595,500.80

MILLING

The mill operated continuously during the year and treated 188,835 tons of ore at a cost of \$1.0449 with an extraction of 95.6%.

The percentage of recovery dropped slightly in the last two periods of the year owing to the premature precipitating action of graphitic schist in the ore broken from development work on the 1250 and 1375-foot levels. Plans are being made to eliminate this graphitic material by means of flotation before treating the ore in cyanide solution. It is expected that the final recovery will be 95.5% of the gold and silver contents of the ore, and that the cost of the additional treatment will not exceed 20 cents per ton; this will make the total milling cost about \$1.25 per ton of ore milled.

Porcupine Crown.—The Porcupine Crown Mines, Limited, capital \$2,000,000 divided into shares of \$1.00 par value, is controlled by the Crown Reserve Mining Company of Cobalt. The officers are: John W. Carson, president and managing director; William I. Gear, 1st vice-president; James G. Ross, 2nd vice-president; James Cooper, secretary-treasurer; John Reid, assistant secretary-treasurer; H. J. Stewart, manager.

Up to February 15 a force of 15 men was employed on development work. It was then decided to resume milling, and the force was increased to 80 men.

On May 15 the property and the plant were transferred to a new company, the Northerown Porcupine Mines, Limited, incorporated under the laws of Ontario with a capitalization of \$3,000,000 in shares of \$1.00 par value. The new company has also acquired the Porcupine Thompson-Krist property consisting of 120 acres lying immediately south and south-east of the Porcupine Crown claim. In consideration of the transfer of the properties the Porcupine Crown Mines, Limited, received 2,000,000 shares of the Northerown stock; and the Porcupine-Krist Mining Company, 1,000,000 shares.

Up to May 15 the Porcupine Crown milled 6,220 tons of ore, averaging \$12.48 per ton; the net value of the production was \$74,773.08 which, with exchange, gave a total revenue from production of \$83,101.55. From May 15 to December 31 the Northerown Porcupine milled 11,678 tons of ore averaging \$8.55 per ton; the net value of the production was \$96,458.32, which, with the exchange on bullion cheques, gave a total revenue from production of \$107,610.84.

The exploration and development work done consisted of 1,824 feet of drifting and 2,787 feet of diamond drilling.

Work was stopped on the Canadian Kirkland property at Kirkland Lake and the option surrendered.

Union.—The Union Mining Corporation, Limited, owns claims P. 2772, P. 2773, P. 2784, P. 2785, P. 8212, and P. 8213, comprising 195 acres in Whitesides township, and also controls 105 acres of adjoining lands. The property is about 28 miles southwest of Timmins, Ont.

The officers are: H. R. Winton, 76 Adelaide St., Toronto, president; G. Cling, vice-president, Chicago; R. O. Witzke, secretary; C. T. Denker, Timmins, Ont., manager.

The company began work on September 9, 1920, with a force of 25 men. A 24 mile wagon road was cut to the claims, and the following log buildings erected: cook-camp, sleeping-camp, and icehouse, each 20 feet by 35 feet, a power house, 35 feet by 35 feet; a smithy, 15 feet by 20 feet; and a sawmill with a capacity of 5,000 feet per day.

Early in 1921 a mining plant was set up; this includes an 80 h. p. locomotive-type boiler, a 570-cubic-foot straight line air compressor, and an 8-inch by 10-inch Jenckes hoisting engine.

A 75-foot prospecting shaft was sunk on one of these claims in 1913; it is planned to enlarge this and use it as a working shaft.

Matachewan

Thesaurus.—Thesaurus Gold Mines, Limited, owns the Nelson group of claims on the north boundary of Baden township at the head of Matachewan Lake. After considerable trenching, an adit was started late in 1919 and driven 50 feet, and a two-compartment shaft was sunk to a depth of 40 feet. Two log camps, about 14 feet by 16 feet, were built. A small outfit of machinery was purchased but was destroyed by a forest fire at Fox rapids on the Montreal river, while being transported to the property. Six men were employed on the claims under the direction of J. C. Nelson.

West Shiningtree

Atlas.—Atlas Gold Mines, Limited, stopped work on its claims at Wasapika lake early in 1920 and up to the end of the year had not resumed. The shaft on the Evelyn vein is now about 40 feet deep.

The head office address of the company is: in care of Joseph Montgomery, 12 King St. East, Toronto. The directors are: president and managing director, A. M. Bilsky; secretary, Israel Singer, Toronto; John Y. Kendall, Montreal; L. Pincus, New York; J. Samen Hof was also on the directorate until his death; his place has not yet been filled.

Herrick.—The Herrick Gold Mines, Limited, owns six claims comprising 275 acres, near the south end of Michiwakenda lake. The company is capitalized at \$2,000,000, and the par value of the shares is \$1.00. The head office is at 10 King St. East, Toronto and the officers are as follows: president, A. H. Chapin, Springfield, Mass.; secretary-treasurer, E. M. White, Toronto; directors: Dr. J. T. Herrick, Springfield, Mass.; Gordon C. Crean, Toronto; E. A. Snowman, Springfield, Mass.; H. H. Sutherland, Toronto; managing director, F. C. Sutherland, Toronto.

Early in the year 3,000 feet of diamond drilling was completed, and during the summer the two-compartment shaft on claim T. R. S. 4105 was deepened from 50 feet to 125 feet. The annual report of the company dated February 9, 1921, states:

The main vein, which was perpendicular from the surface down to about 50 feet, dipped out of the shaft to the west at a depth of between 60 and 65 feet. A crosscut was run on the 100-foot level for approximately 40 feet and the vein picked up. About 60 feet of drifting has already been done on this vein and the values obtained have been satisfactory.

The work, which was in charge of F. L. James, was stopped in the fall and up to the time of writing (March, 1921) had not been resumed.

Wasapika.—Wasapika Gold Mines, Limited, has been succeeded by Wasapika Consolidated Mines, Limited, which received letters patent in January, 1920. The capitalization of the new company is \$6,000,000, divided into shares of \$1.00 par value; 4,282,535 shares have been issued and of these 4,000,000 shares were issued in consideration of the transfer of assets. The shareholders of Wasapika Gold Mines, Limited, received three shares of the new stock for one share of the old.

Since May 26, 1920, no work has been done in the Wasapika mine. On that date the vertical two-compartment shaft was 200 feet; 29 feet of crosscutting had been done on the 200-foot level and 71 feet on the 100-foot. The shaft at this mine is on mining claim T. R. S. 2530; the camps are on T. R. S. 3765.

The directors of the re-organized company are: president, George R. Rogers, Toronto; secretary-treasurer, Elizabeth Lille, Toronto; James E. Way, Reginald E. Hore, L. J. Lahay, W. R. Scott, all of Toronto. The head office is at 1306 Bank of Hamilton Building, Toronto.

White Rock.—White Rock Mining Company, Limited, received an Ontario charter on November 17, 1919, with authority to issue \$1,000,000 capital stock in shares of \$1.00 par value. The company has issued 500,000 shares to William McVittie and Thos. Saville of Sudbury in consideration of the transfer to the company of mining claims W. D. 1417 and T. R. S. 2535 in the township of MacMurchy, the area involved being 70.7 acres, of which 12.4 acres is under Wasapika lake. The directors all reside in Sudbury and are as follows: William McVittie, president; W. Arthur Evans, vice-president; Charles Jessup; Maurice Cohen; Charles McCrea, M. P. P. A. J. Manley of Sudbury is secretary.

In addition to surface prospecting in 1920, the company built camps and purchased a small steam plant. In the spring of 1921 work was resumed and a two-stamp Tremaine mill bought for experimental purposes.

Howry Creek Area

There are three groups of claims in the Howry Creek area on which work was in progress on April 21, 1921, when inspection was made; these are the Bousquet, the Howry Creek, and the Craig-Pollard claims. The Bousquet and Howry Creek are six and a half or seven miles east of Willisville station (revised railway mileage 65.6 miles from Sudbury) on the Algoma Eastern railway. In summer the trip to these two properties is made by a good water route, consisting of Charlton lake and Howry creek; in winter the ice is used to the east end of Charlton lake, from which point a road has been built to the working properties. The Craig-Pollard claims are near West River station, which is at railway mileage 63.4, and are some eight and a half miles west of the claims mentioned on Howry creek proper.

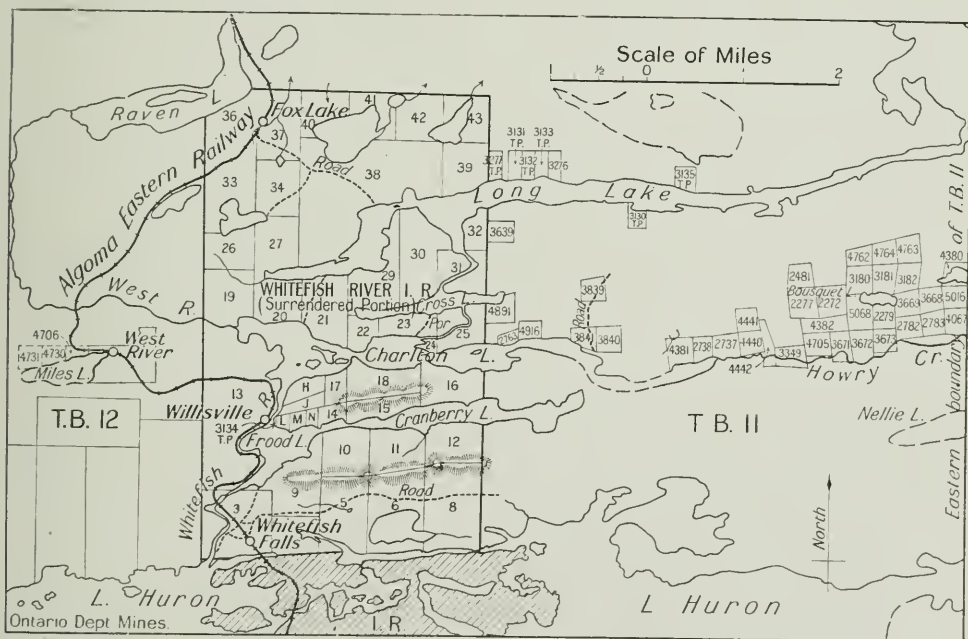
The predominant rock in the area is a quartzite or arkose series; with this quartzite is associated some greywacke and conglomerate. There is also a diorite, which was seen on both the Bousquet and Howry Creek properties and along the railway between Willisville and West River.

Bousquet Gold Mines, Limited.—This company has an authorized capitalization of \$2,000,000, and the shares are of \$1.00 par value. Its head office is at 6 King Street West, Toronto, and the officers are: president, Harold Tough, Willisville, Ont.; vice-president, Robert R. Tough, Willisville, Ont.; secretary-treasurer, Wm. B. McPherson, Toronto; directors: Thomas Baird Tough, Niagara Falls, Ont., James A. Bousquet, Willisville, Ont.

The holdings of this company consist of ten mining claims—S 2272, S 2277, S 2481, S 3180, S 3181, S 3182, S 4382, S 4599, S 4600, and S 4601—in timber berth No. 11 in the Sudbury mining division.

Gold occurs on claims S 3180 and S 3181 in a belt of grey schist, striking approximately east and west and containing some pebbles. The rock looks like a schistose greywacke. C. W. Knight¹, on examining a specimen of the schist under the microscope, found it exceedingly fine-grained and composed of micaeous minerals and quartz grains; in this fine-grained matrix are quartz grains of larger size. The width of this band of schist was not ascertained, but at one point it is exposed for a horizontal width of 24 feet with no contacts visible. A slope sunk in this schist is said to be 44 feet deep, but as it was nearly full of water, only the upper portion could be examined; this showed the schist to contain narrow veins of quartz and ankerite and to have a dip at the surface of 55 degrees to the north. A two-compartment vertical shaft, measuring 6 feet by 10 feet outside, is now being sunk and on the day inspection was made had reached a depth of 20 feet.

Clean and comfortable buildings, consisting of a sleeping camp, a cook house and an office, have been completed on the claims; these are of lumber covered with "paroid." Near the shaft and incline, which are not far apart, is a combined power-house and blacksmith shop; this building contains a locomotive-type boiler, an Ingersoll-Sergeant-Cooper compressor, and an 8 by 10-inch James Cooper hoisting engine.



The vein occurs in quartzite, or arkose. North of the vein and at one point within a hundred feet of it diorite occurs; the contact between the quartzite and diorite is covered by drift but, judging from the topography, it is probably roughly parallel to the vein. This diorite extends through to the Bousquet claims. Mr. Knight kindly made a microscopic examination of a specimen of this rock from the Howrey Creek property and says regarding it; "It is a diorite consisting largely of plagioclase and hornblende; the plagioclase is badly altered to secondary minerals. There are a few micrographic intergrowths of quartz and feldspar."

It is interesting to note that the Long Lake gold mine, now abandoned, lies 25 miles to the northeast of the Bousquet and Howrey Creek groups, and that the orebody was an arkose carrying gold and arsenopyrite and was associated with a diorite.

The Howrey Creek Mining Corporation has sunk several test pits on the vein, the deepest of which is said to be 18 feet. An adit is now being driven N. 20 degrees W. magnetic from the south slope of the ridge on the top of which this vein outcrops. It was 90 feet long on April 21 and a few feet south of the face a vein 18 inches wide had been cut.

Near the portal of the adit a boiler house has been built which also serves as a blacksmith shop. In this building are an Ingersoll Rock Drill Company compressor, 12 inches by 16 inches, and a Nagle 50 h. p. locomotive-type boiler.

Seventeen men are employed by this company. They are temporarily housed on the shore of Howrey creek in some log camps that were built by a lumber company.

The capitalization of the company is \$1,000,000 and the head office is at 77 Victoria Street, Toronto. The officers are: president and treasurer, Glenn C. Bull, Chicago; vice-president and manager, A. L. Kemp, Willisville, Ont.; directors: Sid A. Erwin, Detroit, Mich.; William Benziger, Chicago; W. A. Werrett, Toronto. The company started mining late in 1920.

It is the intention of the company to produce refined arsenic, as well as gold; with this end in view a second-hand arsenic refining plant has been bought and, with the exception of a rotary kiln that went through the ice on Charlton lake in March, 1921, this machinery is now on the property but is not set up.

Majestic Gold Mines, Limited.—This company was incorporated on January 24, 1921, with a capital of \$1,000,000 in \$1.00 shares. The head office is at 213 Carlton Street, Toronto, and the directors are: president, M. A. Attalah, Toronto; Saad Lattief, Toronto; secretary, Charles Gregory, Parry Sound, Ont. This company owns patented mining claims in lot 4, concession II, Beatty township, and has a five-year option on six claims in Coulson township, viz., L 6417, L 6418, L 6419, L 6420, L 6421, and L 6422; both these groups are reached from Matheson on the T. and N. O. railway. In April the company began to prospect under option three claims beside the Algoma Eastern railway on the north shore of Miles lake and about half a mile west of West River station; this station is at railway mileage 63.4. These claims are S 4706, recorded in the name of J. G. Pollard, and S 4730 and S 4731, recorded in the name of George Craig;

The vein being tested is in quartzite, or arkose, and has a strike of S 46 degrees E. for 3 chains and N. 68 degrees E. for 8 chains. The vein consists of quartz, white, gray and, in places, almost black. The average width of the vein for this 11 chains is approximately 8 feet; at one point it is 16 feet wide. Not much mineralization is visible on the surface, but in a test pit which was recently started, occasional bunches of pyrite occur.

Seven men were working on these claims under the direction of Peter Greco. A small boiler was in use to supply steam to a plugger drill.

Anthraxolite

Some diamond-drilling was done during 1920 near Larchwood. This is of particular interest in that it gives information regarding the depth of the sedimentary series in the Sudbury basin. Twenty years ago Wm. McVittie of Sudbury, in the hope of finding a seam of coal, put down a vertical diamond-drill hole to a depth of 1,005 feet. This hole is beside the road on the farm of James H. Davey and is in lot 11, concession II, township of Balfour; it is half a mile south of the C. P. R. main line. The Smith and Travers Company were engaged to continue the drilling of this hole. In August, 1920, a depth of 3,007 feet was reached, and work was then stopped as this was the greatest depth at which the drill would work. Information was not obtained as to how much the drill hole deviated from the vertical, but Mr. McVittie states that the core from the bottom consists of sedimentary rocks, that no norite was encountered and that he intends at some future date to continue the hole still farther.

This drilling was done owing to the presence of black slates and carbonaceous matter in the vicinity. The prospect known as the "Gordon coal mine" lies three-quarters of a mile to the south in lot 10, concession 1, Balfour township; this consists of a vein of "anthraxolite" or anthracitic carbon, and was described by Dr. A. P. Coleman in the Sixth Annual Report of the Ontario Bureau of Mines. Although the material will burn, the ash content, chiefly silica, is high.

Silver

Cobalt

Aladdin.—The Chambers-Ferland mines at Cobalt are operated by Aladdin Cobalt Company, Limited. The stock of this company was held by Aladdin Cobalt Company, Limited, London, England, but the latter company has been liquidated and superseded by the Kirkland Lake Proprietary, (1919) Limited, which is also the holding company of the Tough-Oakes Gold Mines, Limited, and Burnside Gold Mines, Limited.

The directors of Kirkland Lake Proprietary reside in London, England, and are: G. R. Bonnard, Chairman; H. G. Latilla; Capt. C. R. E. Jorgensen; General Sir Bindon Blood, G. C. B.; Hon. K. H. Campbell; R. Simpson. The directors of Aladdin Cobalt Company, Limited are: Capt. C. R. E. Jorgensen, president; Harry B. Sedgwick; G. R. Bonnard. There is also a Canadian advisory board consisting of: Charles A. Richardson, chairman; R. T. Shillington Arthur Ferland; all of Haileybury, Ont. Mr. Richardson is also manager of the company. John Matheson is mine captain and E. S. Gordon, accountant.

In 1920 several veins in the south part of the property were prospected and 1,611 feet of development work was done; this work consisted of 686 feet of drifting, 718 feet of crosscutting, 130 feet of raising, and 77 feet of winze-sinking.

A total of 1,021 tons of ore was sent to the mills and yielded 21,467 ounces of silver.

Beaver.—Owing to the shortage of power and labour in 1920 and the drop in the price of silver from \$1.31 $\frac{3}{4}$ March 1, 1920, to 64 $\frac{1}{4}$ cents an ounce December 31, 1920, the Beaver directorate closed down the mine on December 21, 1920. The mine is being kept pumped out and operations will be resumed when conditions become normal.

The work done during the year was 890 feet of drifting, 228 feet of crosscutting, 167 feet of raising and 3,603 cubic yards of stoping. The production of silver was 157,274 ounces.

The officers and directors are: F. L. Culver, president; F. C. Finkenstaedt, vice-president; H. E. Tremain, secretary-treasurer; W. E. Stevenson, F. L. Lovelace, William T. Mason, and R. Graham, directors; H. L. Donaldson is mine superintendent.

Cobalt A-53.—The Cobalt A-53 Silver Mining Company, Limited, began work early in 1920 on its property in the Gillies Limit. The officers of the Company are: R. J. Hart, 110 Broadway, New York, president; W. H. Matthews, secretary-treasurer, 18 Toronto Street, Toronto; M. W. Simpson, manager, Haileybury.

The shaft was continued from a depth of 55 feet to nearly 100 feet. A total of about 210 feet of drifting and crosscutting, part of which was done in 1920, has been completed on the 55-foot level. A force of 14 men was employed at intervals during the summer and fall.

The company stopped all work on December 8.

Cobalt Provincial.—The Cobalt Provincial Mining Company, Limited, capitalized at \$1,500,000, operated the Provincial mine until August 9, 1920, with a force of 20 men. The officers are: F. G. Logan, Chicago, president; C. L. Painter, St. Louis, Mo., secretary-treasurer; John Reddington, Cobalt, manager.

The work done in the mine in 1920 consisted of: in No. 1 mine, drifting 197 feet, crosscutting 74 feet, raising 40 feet, and stoping 8,600 cubic feet; in No. 2 mine, drifting 62 feet, crosscutting 92 feet, raising 40 feet, and stoping 8,784 cubic feet.

The mill ran 180 days and treated 3,680 tons of ore, averaging 10.65 ounces of silver. The concentrates produced amounted to 66.55 tons with an average silver content of 353.7 ounces per ton, making the average recovery 7.15 ounces.

Colonial.—The Colonial mine is situated on the southwest quarter of the south half of lot 3, concession VI, Coleman township. It is owned by The Colonial Mining Company, Limited, which was incorporated October 19, 1906, with a capital of \$100,000 in \$1.00 shares. The Colonial Silver Mines, Limited, incorporated under the laws of Maine with a capital of \$6,000,000 in shares of \$5.00 par value, owns 99,995 shares of the Colonial Mining Company, Limited.

The mine, which has lain idle since 1914, was reopened for two or three months in 1920 and ten men were employed under the supervision of M. W. Hotchkiss. Drifting was done on the adit level.

The president of the company is E. G. Germer, Erie, Pa.

Coniagas.—The Coniagas Mines, Limited, was incorporated November 24, 1906, with a capital of \$4,000,000, divided into 800,000 shares of \$5.00 par value. The company owns and operates the Coniagas mines at Cobalt and the Coniagas Reduction Company's refinery at St. Catharines. The head office is at St. Catharines and the directors are: R. W. Leonard, C. E., president, St. Catharines; Alex. Longwell, vice-president, Toronto; Fraser D. Reid, general manager, Cobalt; A. L. Bishop and Welland D. Woodruff, St. Catharines; R. L. Peck, Deschênes, Que.; R. P. Rogers, Cobalt.

The following is taken from the annual report of the company for the year ending October 31, 1920:

The Coniagas Reduction Company's plant was in operation for 70% of the possible time during the year, treated 1289 tons (dry weight) of ore, and shipped 896,356 ounces of fine silver. The average number of men employed was 94. A dividend of \$100,000, payable on November 1, 1920, was declared, making the total dividends paid to date by the Reduction company, \$450,000.

The Coniagas mine produced during the year from 97,634 tons of ore hoisted and concentrated 994,235 ounces of silver; the output the previous year was 940,267 ounces. An average price of \$1.225 per ounce was received for the silver, as compared with \$1.06 last year. The cost of mining and milling amounted to 49 cents per ounce, as compared with 35 cents last year; and the cost of smelting, refining and marketing was 7.35 cents per ounce, as compared with 7.45 cents last year. The average cost per ounce of silver produced during the last fourteen years, including all charges, has been 18.76 cents per ounce. Four dividends of \$100,000 each, amounting to 10%, and also a bonus of \$100,000.00 were paid on May 1, 1920; another dividend of 2 1/2% was declared payable on November 1, 1920. These disbursements make a total distribution to date of \$10,140,000, of which \$7,900,000 was paid as dividends and \$2,240,000 as bonuses.

The average number of men employed at Cobalt by the company during the year was 105.04 on a seven-day basis, or 122.55 on a six-day basis.

The concentrating mill and flotation plant operated continuously except during three holidays. The mill ran 92.29% of the possible time, or 91.78% of the total time; the corresponding figures for the previous year were, 92.39% and 79.12%. The tonnage of ore milled was 97,634.3, or an average of 4.91 tons a stamp for 24 hours; 71,743.8 tons were milled the year before, or 4.14 tons per stamp. Mill heads for the year averaged 10.22 ounces per ton. High grade concentrates shipped amounted to 388.60 tons (dry weight) and contained 1,754.6 ounces of silver per ton.

The flotation plant treated all tailings from the concentrating mill and all re-ground sand from the tailings pile. An extraction of 62.75% was made, leaving a tailing of 1.43 ounces of silver to go to waste. Shipments of flotation concentrates amounted to 522.84 tons (dry weight) and averaged 486.25 ounces of silver per ton.

The retreatment of old sand tailings was carried on except during the winter months. The total tonnage reclaimed, 37,695, was re-ground and re-treated, and an average of 1.94 ounces of silver per ton was recovered. A total of 80,264.9 tons has been re-treated to date, and 96,735.1 tons, containing 314,389 ounces of silver, remain to be treated.

A system for re-claiming old slime tailings was put in use on June 15, 1920, and cyanidation of these tailings was carried on continuously until October 15, when the lack of air power necessitated closing down for the winter. A total of 6,440 tons of slime, averaging 6.1 ounces of silver per ton, was treated with an average extraction of 83.87%, and an average tailing of 1.0 ounces of silver. There remain to be treated 33,560 tons of these tailings, containing 208,072 ounces of silver. The cyanide mill at the Buffalo mine is being leased for the cyanide treatment.

There are stacked on the Trethewey property of this company 37,000 tons of sand tailings, containing 173,900 ounces of silver.

Development work was seriously affected during the latter half of the year by the scarcity of underground labour. Small blocks of ground along the north boundary were explored, and the extensions necessary to connect with the Trethewey workings were made. This work developed a considerable tonnage of low grade milling rock. The equipment of the third level as a main haulage way was completed, and an electric system of haulage is now in use.

The reserve of broken ore on stulls in the mine has been increased by 13,521 tons. There is enough ore broken in the mine to keep the mill operating at capacity for over one year.

Ore shipments for the year amounted to 20.4 tons; this consisted of 5.61 tons of high grade ore, averaging 3,309.5 ounces of silver per ton, and 14.8 tons of low grade, averaging 11.44% cobalt. The total shipments from the Coniagas to date amount to 18,279 tons of ore and concentrates containing 28,188,763 ounces of silver.

The work done during the year and also the total work done to date are tabulated below.

	Total to Oct. 31, 1920	Total to Oct. 31, 1919	Development 1919-1920
Shaft Sinking, feet.....	879	879	....
Drifting, feet.....	21,703	20,993	710
Crosscutting, feet.....	11,152	11,007	145
Winzing, feet.....	750	750	....
Raising, feet.....	1,905	1,790	115
	Tonnage Removed to Oct. 31, 1920	Tonnage Removed to Oct. 31, 1919	Tonnage Removed 1919-1920
Crosscutting	55,097.1	54,517.1	{ 130.0 Waste
Drifting	71,021.5	67,941.5	{ 450.0 Ore
Stoping	630,975.0	537,285.1	{ 3,080.0 Ore
Open Cutting	4,880.0	4,880.0	{ 93,689.9 Ore
Winzing and Raising.....	9,048.9	8,654.9	
Shaft Sinking	2,955.0	2,955.0	394.0 Ore
	773,977.5	676,233.6	97,743.9

ORE MILLED IN TONS

Total to Oct. 31, 1920	Total to Oct. 31, 1919	Milled During 1919-1920
693 440.1	595,805.8	97,634.3

MILLING ORE AND ROCK HOISTED IN TONS

	Total to Oct. 31, 1920	Total to Oct. 31, 1919	Hoisted During 1919-1920
Milling Ore	693,440.1	595,805.8	97,634.3
Rock	61,999.0	61,869.0	130.0

From the Trethewey mine, now owned by the Coniagas, 7,482 tons of ore were obtained, which yielded approximately 70,000 ounces of silver. There is still in this mine 5,000 tons of broken ore. The price paid for this property is assured, and it is anticipated that a fair profit will be made on this investment.

Conroy-McAndrew.—The Conroy-McAndrew Silver Mines worked claim 901 in the Gillies Limit south of Giroux lake from May to October 8, 1920.

A compressed air pipe-line was laid to the claim, an engine house and head frame built, and a 6-inch by 8-inch Jenckes hoisting engine set up. In June a two-compartment shaft was started; this was sunk 100 feet, and 170 feet of cross-cutting done at the bottom.

J. A. McAndrew was superintendent and had from four to sixteen men employed.

Cross Lake.—Cross Lake Silver Mining Company, Limited, incorporated on June 28, 1907, with a capitalization of \$1,000,000, worked its property at the south end of Cross lake during 1920. On March 24 the mine became flooded owing to a rising of the waters of Cross lake; this was caused by an accumulation of tailings in Mill creek. Up to this date 14 men had been employed, but from this time until December 19, when work was stopped entirely, 4 men were employed.

The development work done during the year was: in the Cross Lake mine on the 70-foot level, 325 feet of drifting, 86 feet of crosscutting and 67 feet of raising; in the Old Chap mine, 20 feet of drifting on the 130-foot level and 15 feet on the 200-foot level. The work at the Old Chap mine was done during the three or four weeks in which the Cross Lake mine was flooded.

The officers of the company are: Carl Reinhardt, Cobalt, president; George L. Cavanagh, Montreal, vice-president; R. F. Kellock, Cornwall, secretary-treasurer.

Crown Reserve.—The Crown Reserve Mining Company, Limited, has an authorized capital of 2,000,000 shares of \$1.00 par value each. The officers are: John W. Carson, president and managing director; William I. Gear, 1st vice-president; James G. Ross, 2nd vice-president; James Cooper, secretary-treasurer; John Reid, assistant secretary-treasurer; H. J. Stewart, manager; H. R. Bischof, superintendent.

The Crown Reserve mine was worked with a force of 50 men until the month of May when, owing to the drop in the price of silver, the force was reduced to 35 men and the work restricted to the development and exploration of the lower levels of the mine; still later the force was cut to 15 men. The net value of the year's production was \$34,260.00. The total footage driven underground amounted to 2,146.

On the advice of the consulting geologist a deep diamond drill hole was started from the 500-foot level and put down a distance of 1,500 feet. The reason for drilling this hole was to ascertain whether below the present workings there exists another diabase sill similar to the one found on the surface adjacent to and in close relationship with the ore deposits of the Cobalt area. No veins were intersected, nor were there any indications of another sill within this distance.

Some development work was done on the Drummond Fraction property.

The company stopped all work on January 30, 1921.

The Porcupine Crown gold mine, controlled by the Crown Reserve Mining Company, was purchased on May 15, 1920, by the Northerown Poreupine Mines Limited, who also bought the Poreupine Thompson-Krist. The new company owns a total area of 160 acres and is doing considerable development work.

Dickson Creek.—The Dickson Creek (Cobalt) Silver Mines, Limited, continued to work on the northeast quarter of the north half of lot 9, concession V, Bucke township, until December 22, 1920. The incline shaft was continued from 150 feet to 250 feet, and crosscuts driven on the 250-foot level 15 feet north and 15 feet south.

Five men were employed under the supervision of H. Hollands-Hurst of Haileybury, Ont.

Dominion Reduction.—The Dominion Reduction Company, Limited, had an average of 63 men employed in its custom mill on the Nova Scotia claim at Cobalt. The officers are: D. M. Steindler, president; Leslie L. Steindler, secretary; G. W. Perram, manager.

A total of 42,181.59 tons of custom ore was milled from the following sources: Kerr Lake, 29,823.26 tons; Crown Reserve, 5,113.68 tons; Peterson Lake, 3,894.43 tons; Aladdin, 1,017.19 tons; Reliance, 811.27 tons; Right-of-Way, 690.59 tons; Edwards and Wright, 346.83 tons; Silver Queen, 255.52 tons; Colonial, 228.82 tons. In addition, there were milled 50 tons of ore from the Nova Scotia mine, and 4,000 tons of tailings from the bed of Peterson Lake were retreated.

On November 5 the re treatment plant was closed owing to a shortage of power. About the end of the year the mill was closed, as the shipments of ore stopped on account of the low price of silver.

Genesee.—The Genesee Mining Company, Limited, continued to prospect the southwest quarter of the south half of lot 9, concession 1, Bucke township for the first five months of 1920. The development work done during the year consisted of 196 feet of crosscuts on the 350-foot level, and 497 feet of drives and a 22-foot winze on the 500-foot level.

L. F. Steenman, Cobalt, is manager.

Green-Meehan.—Edwards and Wright, Limited, of 120 Bay Street, Toronto, operated the Green-Meehan mine near North Cobalt with a force of about 20 men. H. G. Young was manager.

A 400-cubic-foot Alley and McLellan air compressor, driven by a 75-h.p. motor, was provided to replace the steam-driven compressor formerly in use.

Stopping was continued on the 200-foot level, and 1,559.56 tons of milling ore were shipped to the Cobalt Reduction mill and 346.83 tons to the Dominion Reduction mill. The development work consisted of 1,500 feet of driving and 500 feet of raising.

As the results obtained were not encouraging, the mine was closed down at the end of the year.

Hudson Bay.—In 1920 the Hudson Bay Mines, Limited, worked its No. 1 mine at Cobalt but did nothing at its Gowganda and Kirkland Lake mines.

For the fiscal year ending August 31, 1920, the development work done consisted of 262 feet of crosscutting, 107 feet of drifting, and 40 feet of raising. There were hoisted and milled 20,308 tons of 6-ounce ore; of this total, 316 tons were from development, 9,554 tons from stopes, 4,927 tons from open cuts, and 5,511 tons from surface dumps. The concentrates produced amounted to 344 tons containing 95,444 ounces of silver. The mining cost was \$55,234 and the milling cost \$39,837.44. An average price of \$1.155 per ounce was received for silver. The profit for the year's operations was \$3,086.62.

The mill was shut down on October 12 and the working force reduced from 40 to 13 men. As the ore reserves containing about 30,000 ounces were almost depleted, the men retained were put on development work. This work during the winter months produced fairly satisfactory results, but the continued decline in the price of silver caused all work to be suspended on April 11, 1921.

The officers of the company are: A. L. McKelvie, New Liskeard, president; William H. Kinch, Buffalo, N. Y., vice-president; F. L. Hutchinson, New Liskeard, secretary-treasurer; D. M. McPhail, Cobalt, manager.

Kerr Lake.—The Kerr Lake mines at Cobalt are owned and operated by Kerr Lake Mines, Limited. This company has now a capitalization of \$2,400,000, which is divided into shares of \$4.00 par value. The head office is at 61 Broadway, New York, and the board of directors consists of: Adolph Lewisohn, president; Sam A. Lewisohn, vice-president; E. H. Westlake, secretary-treasurer; Julius H. Susmann, J. Parke Channing, D. M. Steindler, J. J. Steindler, Wm. B. Joyce, Thos. L. Herrmann. H. A. Kee is manager, and an average of 90 men is employed.

The manager's report for the fiscal year ending August 31st, 1920, states:

The gross production for the fiscal year amounts to 956,050 ounces of silver, 42,654 pounds of cobalt, and 34 pounds of mercury. These figures include 88,598 ounces of silver on hand August 31, 1920, according to inventory. Of the total, 629,216 ounces of silver, 42,654 pounds of cobalt, and 34 pounds of mercury were produced from shipping ore and 326,834 ounces of silver from low grade ore milled by the Dominion Reduction Company at Cobalt.

The year's development work amounted to 2,969 feet making the total to date 59,891 feet. No new veins of much importance were encountered, but both high grade and milling ores were found in extensions of ore shoots in old stopes. During the year 17,960 tons of ore and 5,191 tons of waste were hoisted. The ore milled, including that obtained from the dump, was 23,150 tons and contained 12.5 ounces of silver per ton, as compared with 17.3 ounces in 1919. The cost of production was 56.04 cents per ounce of silver. This sum was composed of: mining and development charges, 25.48 cents, shipment and treatment charges, 26.69 cents, and administration charges 3.87 cents.

The company has paid in dividends to date \$8,310,000.00. On September 22, 1919, a capital distribution of \$600,000 or \$1.00 per share was made.

During the winter of 1920-21 work was restricted to the No. 3 mine and to the Hargrave mine adjoining, which was under option. Forty to fifty men were employed during this period. The Hargrave mine was bought in March for \$16,250.

La Rose.—La Rose Mines, Limited, capital \$1,500,000 in shares of \$1.00 par value, operates several mines at Cobalt. The officers are: D. Lorne McGibbon, president; Shirley Ogilvie, vice-president; Stephen J. Le Huray, secretary-treasurer; G. C. Bateman, general manager. The head office is at 260 St. James Street, Montreal.

The general manager's report for 1920 gives the production for the year from the La Rose properties as 410,445 ounces of silver and 385 tons of cobalt, contained in the ore and for which payment was received. The total output was valued at \$313,995.74, and operating costs amounted to \$300,716.01; the net profit on production for the year was, therefore, \$13,279.73. Owing to the greater output and to economies effected, the cost per ounce of silver was reduced from \$1.05 in 1919 to 73 cents in 1920. The net current surplus was \$490,936.00 at the end of the year.

The concentrator treated 33,035 tons of ore of an average grade of 14 ounces as compared with 11.1 ounces in 1919. The concentrates obtained totalled 1,013.6 tons and contained 392,052 ounces of silver, or an average of 387 ounces per ton.

The underground work done during 1920 in the La Rose, Princess, and Violet is tabulated below:

	Shafts ft.	Drifts ft.	Crosscuts ft.	Raises ft.	Stations cu. yds.	Stopes cu. yds.
La Rose.....		118.5		183.5		4635
Princess.....		551.5	195.5	47.	6	3702
Violet.....	72	526.	610.5	32.	77	1746
Total.....	72	1196.0	806.0	262.5	83	10083

Details regarding the several mines of the company are as follows:

La Rose.—The La Rose mine shipped to the concentrator 10,134 tons of ore, averaging 16.2 ounces per ton, and in addition 3,873 ounces were obtained from high grade and cobalt ores, making the total silver production 167,533 ounces. The ore came from pillars and old stopes, principally on the "Powder House" vein; most of this vein has been worked out, and 3,000 tons remained broken in the stopes at the end of the year.

Violet.—In October the shortage of power forced a cessation of work on the lower levels, and, in view of the uncertain outlook for power, it was decided to allow them to remain flooded until spring. Production for the year was 81,476 ounces of silver.

Princess—The Princess was a steady shipper of milling ore, and a fair production for 1921 is assured. This mine shipped 15,650 tons of ore containing 14.3 ounces per ton, and high grade ore containing 8,276 ounces; the gross production was, therefore, 167,533 ounces.

University.—The University mine is operated by the University Mines, Limited, and La Rose Mines, Limited, owns 97.26% of the stock. Work at No. 3 shaft was continued, and a total advance was made of 2,263 feet in drifts, crosscuts and raises. A new ore body was found about 20 feet above and a short distance south of the 90-foot level; a stope, 170 feet long, was opened up on this ore body, which consists of milling ore with stringers of high grade and at the west end of the stope is consolidated into a three-inch vein of high grade ore. The total net production for the year was 100,895 ounces of silver. This was obtained from 6,086 tons of milling ore, averaging 10.3 ounces per ton and from which the concentrator recovered 49,294 ounces and 20.6 tons of high grade averaging 2,500 ounces per ton.

Early in 1921 a promising parallel ore body, carrying about three inches of high grade ore, was encountered a short distance to the north in an area of Huronian slates.

The average number of men employed was 105.

Lumsden.—The Lumsden mine was worked under lease until December 14, 1920, by Campbell and Fairburn (Camburn Silver Mines, Limited). Major J. H. Rattray was manager and had 12 men employed.

The work performed during the year consisted of: 1000 feet of drifting and crosscutting on the 300-foot level, the sinking of a 30-foot winze, and 9,314 cubic feet of stoping. A body of medium grade ore was opened up.

McKinley-Darragh-Savage.—The McKinley-Darragh-Savage Mines of Cobalt, Limited, capital, \$2,500,000 in shares of \$1.00 par value, operates the McKinley-Darragh-Savage mines. The Company's offices are at the Trusts and Guarantee Building, Toronto and Cobalt, Ont. The officers of the Company are: J. R. L. Starr, president; Thos. W. Finucane, vice-president; Harper Sibley, treasurer; J. H. Spence, secretary; T. R. Finucane, general manager; H. C. McCloskey, resident manager.

The mines and mill, employing 155 men, were in operation during 1920, and the tailings mill ran from May until the power shortage in November.

The ore removed from mines and dumps was 63,528 tons all of which was milled, and, in addition, 30,205 tons of sand tailings were retreated. The silver recovered during the year was 627,360 ounces and a total of 613,483 ounces was shipped.

The silver recovered was distributed in the following classes of products:—

Classification	Tons of Product	Ounces of Silver	Percentage of Total	Average Ozs Per Ton
Nuggets.....	.256	5,110	0.8	19,960.9
Below 550 ounces per ton.....	66.765	26,055	4.2	390.2
550 to 1000 ounces per ton.....	85.382	63,012	10.0	738.0
1000 to 2000 ounces per ton.....	38.131	47,143	7.5	1,236.3
Over 2000 ounces per ton.....	9.347	36,172	5.8	3,869.9
Sand Concentrates.....	337.921	234,762	37.4	694.7
Flotation Concentrates.....	608.330	215,106	34.3	353.6
Totals.....	1,146.132	627,360	100.0	547.4

The total production of silver to date has been 19,622,403 ounces. The year's underground work consisted of: 1110 feet of crosscutting, 1084 feet of drifting, 535 feet of raising and the breaking of 38,990 tons in the stopes.

The ore broken in the mine amounts to 25,000 tons and there was also developed during the year a considerable tonnage that has not yet been broken; but the greater portion of this ore on hand cannot be profitably treated at present prices of silver.

The fall in the price of silver during 1920 from \$1.31 an ounce at the beginning of the year to 64 $\frac{1}{4}$ cents at the close caused operations to become unprofitable as the average cost of producing silver was 85 $\frac{1}{2}$ cents an ounce. This resulted in an operating loss of \$17,468.57, and a total net loss of \$40,574.24 for the year.

The mine was shut down at the close of the year.

Three dividends of 3%, amounting to \$202,292.28 were paid during 1920 and the surplus now stands at \$122,735.41.

Mining Corporation.—The Mining Corporation of Canada, Limited, has an issued capital of \$8,300,250 in charges of \$5.00 par value. The officers of the company are: president, J. P. Watson; 1st vice-president, W. R. P. Parker; 2nd vice-president, G. M. Clark; directors, E. H. Rose, J. G. Watson, Thomas Plunket, Capt. C. E. Trafford; consulting engineer, Scott Turner; resident manager, M. F. Fairlie, secretary, W. W. Perry. The head office is at 1512-1520 Bank of Hamilton Building, Toronto.

The silver production from the company's Cobalt properties for the year 1920 was 1,664,018 ounces, an increase of 433,365 ounces over the 1919 production. The net profits were \$579,569.96, and the surplus stands at \$3,268,628.53.

The average number of men employed was 227, of whom 122 were engaged in mining and 93 in the mill.

The ore reserves on the old properties are estimated to contain 830,940 ounces of silver, and those in the Buffalo mine are estimated at 1,350,060 ounces making a total of 2,181,000 ounces.

An active search for new properties was continued during the year, about 300 properties being examined. An interest was taken in an option on the Flin Flon gold-silver-copper property in Manitoba. This option lapsed on March 31st, 1921 and early in May the company acquired by purchase a majority interest in this property on which in the past few years over half a million dollars has been expended in exploration work and diamond drilling.

The resident manager's report for 1920 summarizes the operations in great detail:

Satisfactory underground developments permitted a large increase in tonnage milled and in silver production during the year. The production figure of 1,664,018 ounces as compared with 1,230,653 ounces for the previous year, shows an increase of 433,365 ounces.

In spite, however, of this improvement, the unexpected drop in the market price of silver has resulted in reduced net profit for the year's operations.

A pronounced shortage of labour hampered efficient operation during the greater part of the year, in spite of the fact that wages in both underground and mill work showed the highest average in the history of Cobalt.

Shortage of power in the latter part of the year compelled suspension of tailing treatment operations and proportionately reduced production from that source.

The amounts of ore broken and ore hoisted from the time were 38,258 tons and 51,171 tons respectively.

SILVER PRODUCTION

Owing to various changes in milling practice by the Cobalt Reduction Co., Ltd., and to the fact that the Reduction Company was treating a considerable tonnage of purchased ore in its low grade mills, it became difficult to segregate and return to the Corporation the various products from ore treated. A wide difference in both the character and assay value of the ore from different mines added to the difficulty.

For the above reasons, and also as no adjustment of treatment charges had been made with the Reduction Company to cover its increased costs since 1915, a new agreement, dating from Oct. 1st, 1920, was made, under which the Reduction Company purchases the ore of the Corporation. In payment, the Reduction Company returns to the Corporation, in the form of refined silver bullion, a percentage of the silver contents of the ore treated. This percentage varies with the average assay value of the ore delivered each month and ranges from 80% for ore assaying up to 15 ounces per ton to 91% for ore assaying over 41 ounces per ton. The Reduction Company charges the Corporation \$8.00 per ton for treatment, including high grade treatment.

ORE RESERVES

Townsite, City and Lake Mines.—The ore reserve estimate shown below covers the Townsite, City and Lake properties of the Corporation.

	Tons Ore		Ounces Silver	
	1920	1919	1920	1919
Total	28,950	38,735	830,940	1,307,220

The total is made up of 16,981 tons, carrying 453,325 ounces, in place, and 11,969 tons, carrying 377,615 ounces, of broken ore in stopes.

A decline on both tonnage and ounces in reserve will be noted. During 1920, 51,918 tons containing 1,591,890 ounces, were mined from the above mentioned properties, figures greatly in excess of the total reserves shown at the end of 1919.

Buffalo Mine.—The reserves, in the Buffalo, stand at the end of the year as follows:

Tons Ore	Ounces Silver
74,653	1,350,060

The total is made up of 41,336 tons, carrying 826,720 ounces, in place, and 33,317 tons, carrying 523,340 ounces, of broken ore in stopes.

TOTAL ORE RESERVES

	Tons Ore		Ounces Silver	
	1920	1919	1920	1919
Broken.....	45,286	23,019	900,955	866,945
In Place.....	58,317	15,716	1,280,045	440,275
Total.....	103,603	38,735	2,181,000	1,307,220

Townsite, City and Lake Mine.—Diamond drilling operations begun towards the end of the year gave results indicating the possibility of developing new ore. Exploration has not yet reached the point where the importance of this work may be estimated.

TAILING

There remain in the bed of Cobalt lake approximately 275,000 tons of tailing available for reclaiming. The value of this material under present market conditions is problematical. Lower costs and higher price of silver must obtain before profitable treatment of this tailing can be resumed.

NEW PROPERTIES

Foster.—The tonnage of this mine amounted to 9,284 tons which, after milling, gave a production of 127,355 ounces in 1910. This is not included in production figures of the Mining Corporation.

The property was temporarily closed in November to relieve the power shortage situation, and work will be resumed when power is again available.

Buffalo.—This property owned by the General Examining & Developing Co., Limited,¹ was actively developed during the year with very satisfactory results. Practically no ore was treated in 1920, operations being confined to breaking and storing for reserve.

THE COBALT REDUCTION COMPANY, LIMITED

Concentrating Plant.—Except for four days lost owing to legal holidays, this plant ran continuously throughout the year. Sixty stamps ran 494,004 out of a possible 521,076 stamp hours or 94.8% of the possible running time.

The tonnage of mine ore treated in the low grade plant was 63,416 tons against 38,467 tons in 1919. This tonnage was shipped by the following mines:—

Mining Corporation.....	51,918.19
Central Operating Co., Limited (Foster Lease).....	9,280.16
General Examining & Developing Co. Limited (Buffalo Mine).....	475.00
Sundry.....	1,742.71
	63,416.06

Comparative details of concentration treatment for 1920 and 1919 follow:

	1920	1919
Tons treated.....	63,416.06	38,466.52
Average assay.....	28.80	32.68
Ounces contained.....	1,826,648.04	1,256,960.26
Tons concentrate produced.....	910.78	457.99
Average assay.....	1,522.66	2,049.17
Ounces contained.....	1,386,809.45	938,500.83
Percentage of Extraction by concentration.....	75.92	74.66

Cyanide Plant.—This plant ran 344 days in 1920 treating the slimes produced in crushing mine ore, and middlings from the Buffalo flotation plant.

From November 23rd to December 11th the plant was closed, all slimes being treated by flotation. However, owing to high mill heads at this time, it was necessary to re-open the cyanide plant. From September 16th to November 23rd, only middlings produced at the Buffalo mill were cyanided.

1. All the shares of this Company are owned by the Mining Corporation of Canada, Limited.

The tonnage treated was 36,663 against 35,029 tons in 1919. The baser character of the ore and the inclusion of flotation middlings resulted in a lower extraction by cyaniding.

Details of treatment follow:

	1920	1919
Tons cyanided	36,662.53	35,029.14
Average assay	10.62	9.13
Ounces contained	389,444.23	319,805.85
Ounces recovered	306,531.34	258,362.07
Percentage of extraction	78.71	80.79

Flotation Plant.—Early in the year the Buffalo flotation plant of the General Examining and Developing Co., Limited, was leased. During the winter an aerial tramway was installed to transport the tailing from the bed of Cobalt lake to this plant for treatment. Pipe lines were installed between the cyanide and Buffalo plants for the transfer of slime and middlings.

Details of tonnage, etc., are given below:

Tons of Cobalt Lake tailing treated	71,476.00
Average assay	3.92
Ounces contained	279,932.76
Tons of mine ore slime treated	12,000.72
Average assay	8.47
Ounces contained	101,663.41
Total tons treated	83,476.72
Average assay	4.57
Total ounces contained	381,596.17
Tons flotation concentrate produced	245.83
Average assay	792.59
Ounces contained	194,842.11
Percentage of extraction by flotation	51.06
Tons of middlings to cyanide plant	6,379.10
Average assay	15.47
Ounces contained	98,661.60

SUMMARY OF MILLING OPERATIONS

		Extraction per cent.
Tons of mine ore milled	63,416.06	
Tons of Cobalt Lake tailing milled	71,476.	
Total tons	134,892.06	
Average assay	15.62	
Ounces contained	2,106,580.80	
Table concentrate produced, ounces	1,386,809.45	65.83
Flotation concentrate produced, ounces	194,842.11	9.25
Bullion produced from cyaniding, ounces	306,531.34	14.55
Total ounces produced	1,888,182.90	89.63

High Grade Plant.—This plant treated all the table concentrate produced in the low grade mill and all the flotation produced in the Buffalo mill with the exception of 46 tons which will be shipped to the smelter. In addition 406.85 tons of purchased high grade ore and concentrate were treated. The total was 1,507.17 tons against 1,059.04 tons in 1919. The refinery produced 2,113,326.08 ounces of refined bullion of which 1,806,794.74 ounces were from the high grade plant and 306,531.34 from the low grade cyanide plant.

Residues from the High Grade Plant were shipped to the smelter, payment being made for the silver and cobalt contents. Shipments in 1920 amounted to 1,530.71 tons.

Nipissing.—Nipissing Mines Company, Limited, has an authorized and issued capital of \$6,000,000 divided into shares of \$5.00 par value. The officers of the company are: E. P. Earle, president; Alexander Fasken, secretary; P. C. Pfeiffer, treasurer; The directors are: W. H. Brouse, John H. Black, and David Fasken of Toronto; Richard T. Greene, E. P. Earle, August Heckscher, and R. B. Watson of New York. The head office is in the Excelsior Life Building, Toronto, and the New York office at 165 Broadway.

The operating company is the Nipissing Mining Company, Limited; the authorized and issued capital stock consists of 2,500 shares of \$100.00 par value and is all owned by Nipissing Mines Company, Limited. The officers are: David Fasken, president; E. P. Earle, vice-president; Alexander Fasken, secretary; P. C. Pfeiffer, treasurer. The directors are: John H. Black and David Fasken of Toronto; E. P. Earle, Richard T. Greene and R. B. Watson of New York. The operating officers are: R. B. Watson, general manager; Hugh Park, manager; James J. Denny, mill manager. The head and mine offices are at Cobalt, Ont.

During the year ending December 31, 1920, 83,348 tons of ore was produced; this consisted of 1,024 tons of high grade ore and 82,324 tons of low grade.

In the high grade mill the materials treated were: 1,017 tons Nipissing ore, assaying 1,146 ounces silver; 857 tons Nipissing concentrates, assaying 1,240 ounces silver; 229 tons of custom ore, assaying 2,172 ounces silver; 64 tons by-products, assaying 1,674 ounces silver. No change was made in the methods of treating high grade ore.

In the low grade mill 81,700 tons of ore averaging 27.38 ounces silver were treated; the average tailing was 2.60 ounces—a recovery of 90.55%. A new re-grinding plant, consisting of a 4-foot by 24-foot tube mill in closed circuit with two duplex Dorr classifiers with 15-foot bowls, has been added to take the overflow from the classifiers of the main crushing plant. This product contains 30% to 40% of sand, 10% being plus 200 mesh. By re-grinding with one-inch iron balls the percentage of sand is reduced by one half, and the final product going to the cyanide tanks carries only 1% to 2% plus 200 mesh; this re-grinding effects an additional saving of about one ounce of silver per ton. With this safeguard in operation, the picking plant was shut down on December 1, and the high grade ore is now sent with the low grade to the stamps; the roughing tables following the stamps are relied upon to collect the high grade cobalt mineral. Since these changes were made, the recovery has been increased to over 95%. The treatment costs of the low grade ore, including transportation and picking plant expenses, averaged \$4.94 per ton.

The Nipissing mines produced 3,332,303 ounces of silver in 1920; this had a gross value of \$2,503,223.72 and a net value of \$2,418,645.17. The total cost of producing this silver was \$1,246,404.82—an average cost of \$15.068 per ton of ore, or 37.4 cents per ounce of silver. The shipments from these mines since their discovery in 1903 have contained a total of 58,835,571 ounces of silver; this silver, and the cobalt, nickel and arsenic paid for have paid for have had a gross value of \$39,951,344.46 and a net value of \$38,349,499.07. Shareholders have received in dividends, \$22,740,000.00.

The underground work done in 1920 consisted of:

DEVELOPMENT

The total amount of underground advance was about the same as in recent years. Work was carried on in 104 faces, exclusive of stopes.

Exploration into new territory and the closer examination of areas in the immediate vicinity of known veins amounted to 56% of the total advance.

No large veins of importance were found. A number were sufficiently encouraging to require development and in a few instances this work produced small amounts of ore, mostly mill rock.

Drifting and raising on new small veins amounted to 44% of the total advance, most of the work being unproductive. Stopping operations were carried on in 22 stopes.

There were no new developments of much importance on the older veins. They continued to be the main sources of production, and in every case exceeded expectations.

General underground development has reached the point where it is now possible to maintain only one central hoisting shaft on each side of the lake, all haulage from surrounding workings being done by electric locomotives.

Shaft 63.—Operations were considerably increased during the year, the advance at this shaft amounting to 44% of the total.

A haulage crosscut to tunnel 96 was completed, which has simplified all operations in the township area now being worked.

Exploration resulted in finding several new veins, mostly small and low grade, but at least three or four will be productive.

The veins to be worked through shaft 63 have a combined reserve of over a million ounces.

Shaft 64.—The only work done at this shaft consisted in the completion of a long crossect to the northern limit of the property. Nothing of interest was found.

New development from shaft 73 has connected the lower levels of vein 64 with the direct haulage system to the main shaft.

Shaft 73.—Nearly one half of the total advance was done through this shaft. Stopping operations also provided most of the underground tonnage sent to the mill.

Considerable exploration work found only a few veins of little importance.

Vein 490 continued to be the largest individual producer; it also has the most in reserve.

Considerable work was done on vein 544, but it will not produce much ore. Ore occurrences in this vein have always been erratic. Two branch veins produced small amounts of good ore.

Shafts 80 and 128 were not worked during the year.

A summary of underground work done in 1920 follows:

Shaft No.	Drifting feet	Crossecting feet	Raising feet	Total feet	Stopping cubic yards
63	1784	1513	291	3588	900
64	12	623	15	650	
73	1058	2525	393	3976	11,576
Totals.....	2854	4661	699	8214	12,476

The ore reserves are estimated to be as follows:

	Tons	Assay	Total silver content in ounces
High grade ore.....	1,851	1,183	2,188,903
Low grade ore.....	70,814	19.5	1,379,224
Totals	72,665	49.1	3,568,127

In the annual report of the company for 1920 the general manager says:

The average grade of the total ore going to the mills was 41.6 ounces per ton compared with 49.9 ounces in 1919.

It must be realized by stockholders that the Nipissing property has been under development for sixteen years and that, therefore, important veins are not as likely to be found in the future as they have in the past.

The usual scouting for new properties was carried on in Canada and elsewhere. A majority interest in a promising iron property near Brewster, N. Y., was acquired at a very satisfactory price. After putting down two dry holes on the oil lease at Henrietta, Texas, work was discontinued, but it is possible that further drilling will be done by outside parties for an interest in the lease.

During the year two dividends of five per cent each and two dividends of ten per cent each were paid, making a total disbursement to shareholders of \$1,800,000.00.

The average number of men employed was 275.

Northern Customs and Bailey.—Northern Customs Concentrators, Limited, operated its mill at mileage 104 on the T. and N. O. Railway during the first quarter of the year. On April 1, after buying the Bailey silver mine at Cobalt, the company was liquidated and the operations continued under the name of the Bailey Silver Mines, Limited, the directorate of which is the same as that of the liquidated company.

From January 1 to March 31 a force of 43 men was employed in the mill and 14,620.6 tons of ore were treated. This ore came from the following sources: La Rose mines, 9,366.3 tons; Silver Cliff mine, 3,562.8 tons; and Chambers-Ferland mine, 1,691.5 tons.

From April 1 to the end of the year an average of 44 men was employed in the mill and 45,792 tons of ore were treated. This ore came from the following mines: La Rose, 29,880 tons; Silver Cliff, 11,343.8 tons; Chambers-Ferland, 1,515.7 tons; Right of Way, 1,999.5 tons; Bailey, 1,053 tons.

The officers of the company are: A. J. Young, president, Toronto; C. J. Booth, vice-president, Ottawa; F. J. Bourne, general manager, Cobalt; C. J. B. Armstrong, superintendent, Cobalt.

The mining work done by both companies is summarized below:

Bailey.—The Bailey mine was reopened on May 10 with superintendent A. S. Holmes in charge. A crosscut was driven south from the shaft on the fifth level for a distance of 300 feet. This encountered two veins in the first of which 50 feet of drifting and 20 feet of raising were done. From old pillars and stopes 1,053 tons of ore were obtained. Twelve men were employed.

Chambers-Ferland.—During the first half of the year a shaft pillar in the No. 1 Chambers-Ferland mine was stoped. From June to September some development work was done, access being obtained through the Right of Way shaft; this work consisted of 30 feet of raising and about 200 feet of crosscutting on the 90-foot level. Sixteen men were employed and 3,429 tons of milling ore was shipped. The mine was closed in September.

Silver Cliff.—The companies continued to work the Silver Cliff mine under lease until Nov. 11 when it was shut down. Milling ore, amounting to 14,906.6 tons was produced, and 22 men were employed.

Nova Scotia.—From June, 1920, to May 1, 1921, the Dominion Reduction Company had from four to eight men employed in stoping cobalt ore on the 50-foot level in the Nova Scotia mine.

O'Brien.—The O'Brien mine at Cobalt is owned and operated by M. J. O'Brien, Limited, of which M. J. O'Brien, Renfrew, is president; J. A. O'Brien, Ottawa, vice-president, and J. G. Dickenson, Cobalt, mine manager.

The production for the year has equalled that of former years and considerable ore has been developed to replace that taken out during the year. An average of 165 men was employed.

The progress underground for the year and the totals to date are tabulated below:

	1920	Total to date
Drifting.....	1,318 feet	54,319 feet
Crosseutting.....	934 feet	
Raising.....	42 feet	4,427 feet
Sinking.....	68 feet	
Stoping.....	45,065 tons	415,469 tons

Oxford.—Oxford Cobalt Silver Mines, Limited, was incorporated on March 27, 1919, with an authorized capital of \$1,000,000 in shares of \$1.00. The company owns claims A-100 and C-1,000 in the Gillies timber limit about half a mile south of Giroux lake. The officers are: A. H. Wilson, president; J. R. Shaw, vice-president; E. A. Ray, treasurer; G. W. Mahon, secretary; J. W. Russell, general manager. The head office is at Woodstock, Ont.

Work was started in March and a shaft was sunk on claim C-1,000 to the depth of 163 feet, Henry Sankey doing the work under contract. A level was opened at 150 feet, a crosscut driven north for 44 feet, and 138 feet of drifting done on the vein. Fifteen men were employed from April to October inclusive.

Peterson Lake.—The Peterson Lake Silver Cobalt Mining Company, Limited, continued to work its mine until the last week of 1920, when it was decided to shut down owing to the drop in the price of silver.

The development work done during the year included 137 feet of crosscuts and 483 feet of drifts.

The shipments of ore and concentrates for the year were as follows: 23,023 tons of flotation concentrates, containing 6,575.8 ounces of silver and obtained from 1,427 tons of dump ore milled at Peterson lake; 5,621 tons of high grade ore, containing 13,987 ounces; 39,946 tons of tailings concentrates, containing 5,435 ounces and obtained from the treatment in the Peterson Lake Dominion mill of 2,688 tons of lake tailings containing 11,450 ounces. 3,895 tons of milling ore, containing 69,661 ounces and shipped to the Dominion Reduction Company's mill; the total shipments, therefore, amounted to 3,963.7 tons, having a gross silver content of 95,658 ounces without any deductions by mills or smelters. The shipments included 791 pounds of cobalt containing high grade ore, averaging 7 $\frac{1}{2}$ % cobalt.

C. A. Filteau is manager and an average of 20 men was employed.

Reliance.—The Reliance claim in Coleman township was worked under lease by Shaw and Dean during the first seven months of the year. A small amount of development work was done, and 811.27 tons were shipped to the Dominion Reduction Company's mill. From four to six men were employed.

Right of Way.—The Right of Way Mines, Limited, resumed work at its No. 4 shaft in February. Fifty feet of drifting were done and the first shipments were made in April. A total of 690.59 tons was shipped to the Dominion Reduction mill and 1,999.5 tons to the Northern Customs. An average of 20 men was employed up to July 14, when the company stopped work.

The officers are: C. Jackson Booth, president; E. A. Larmonth, vice-president; James Cunningham, secretary; D. H. Angus, manager. The head office address is Central Chambers, 46 Elgin Street, Ottawa.

Ruby.—On August 1, 1920, a Cobalt syndicate began to exploit the Ruby Silver claim, which consists of 40 acres in Bucke township, west of and adjoining the Red Rock claim; shortly after, the Ruby Operative Mines, Limited, was formed and continued work until the end of February, 1921. The officers of the company are: C. H. Moore, president; Lieut.-Col. E. F. Armstrong, vice-president; Dr. E. W. Mitchell, Kenneth McDonald, and Bernard W. Hartley, directors; P. J. Hart, secretary-treasurer.

The company did the following work underground: drifted 30 feet; sank an inclined winze, about 48 feet deep, from the 70-foot level on the vein; and mined and shipped 187 tons of ore to the Cobalt Reduction Company's mill.

Silver Queen.—The Silver Queen mine was operated under lease by W. J. Post, who employed from two to six men. Shipments consisted of 9 tons of medium grade ore, worth about \$2,000 and 255 tons of milling ore containing about 8 $\frac{1}{2}$ ounces; the latter material was shipped to the Dominion Reduction Company. About 100 feet of crosscutting and 50 feet of raising were done, most of which was on the first level.

Temiskaming.—The Temiskaming Mining Company, Limited, has an authorized and issued capital of \$2,500,000.00 in shares in \$1.00 par value. The directors are: president, J. P. Bickell, Toronto; vice-president, J. B. Tudhope, M. P., Orillia; W. J. Sheppard, Waubashene, Ont.; W. Linton, Toronto; N. S. Dunlop, Montreal; Joseph Errington, San Francisco; Strachan Johnston, K. C., Toronto. M. P. Van der Voort, Toronto, is secretary and H. G. Lauz, Toronto, is treasurer. The head office is in the Standard Bank Building, Toronto.

The end of the Company's financial year has been changed from December 31 to June 30 to conform to the fiscal period of the Blue Diamond Coal Company, Limited, a half of whose capital stock had been bought by this company. Consequently the report from which the following notes are abstracted covers the eighteen months ending June 30, 1921.

Owing to the drop in the price of silver in 1920, it was first decided to curtail development work and finally to stop it, the supply of ore for the mill during October and November coming entirely from the broken ore reserves. In November, the shortage of power introduced another adverse factor, and it was decided to close down the mine entirely.

With a view to increasing the extraction and also treating the accumulated tailings, material was bought for an oil flotation plant consisting of two units, and one unit with a capacity of 125 tons per day had been about completed when the mine was closed.

The development work done during the year consisted of: drifting, 73 feet; crosscutting, 377 feet; raising, 366 feet.

The mill treated 34,911 tons of ore from which were obtained products having the following silver content:—jig concentrates, 63,797.5 ounces; sand concentrates, 161,148.0 ounces; slime concentrates, 17,406.4 ounces; high grade ore, 677.3 ounces; or a total of 243,029.2 ounces.

The profit and loss statement for the eighteen months is as follows:

Production:			
Ore sales.....	\$271,330.05		
Less ore on hand Dec. 31, 1919.....	92,035.38		
			\$179,294.67
Costs:			
Development and exploration.....	\$31,828.80		
Mining.....	162,137.77		
Milling.....	84,166.42		
Shipping and marketing.....	8,380.94		
	286,513.93		
Administrative and General:			
General expense, mine office.....	\$44,442.98		
Taxes, insurance, and general expense.....	35,582.56		
	80,025.54		
			\$366,539.47
			\$187,214.80
Miscellaneous Earnings:			
Interest, discount and exchange.....	49,049.76		
Miscellaneous.....	2,429.54		
			51,479.30
Deficit transferred to surplus.....			\$135,765.50
The company's surplus is now \$728,253.20.			

Waldman.—The lease of the Waldman mines was transferred from Mosher and McKay to the Camburn Silver Mines, Limited, (incorporated on July 7, 1919, with a capital of \$1,500,000) and the work was continued during the first half of the year with a force of five men. The work consisted of 58 feet of drifting, 21 feet of raising, and 330 feet of stoping. Major J. H. Ratray was in charge.

Elk Lake, Gowganda and Maple Mountain

Bonsall.—The Bonsall group of claims at Gowganda belongs to The Bonsall Mines, Limited, incorporated on September 25, 1909, with \$3,000,000 capital stock. The president of the company is Clifford Sifton and the secretary is Harry Sifton, 18 Wellington Street East, Toronto. Little, if any, work has been done on these claims since 1910, with the exception of a small amount by M. J. O'Brien, Limited, in 1919.

In 1920, George Glendinning of the Standard Bank Building, Toronto, had 15 men employed from March to July doing trenching, sampling, and some further exploratory work underground. All of the exploratory work was done on claim R.S.C. 83 from the shaft which is on the line dividing this claim from claim R. S.C. 82 to the west. On the 70-foot level Mr. Glendinning did 100 feet of drifting and 70 feet of raising, on the 125-foot level, 180 feet of drifting. He also pumped out and sampled Nos. 2 and 3 shafts, which are on claim R.S.C. 84.

Cane.—Cane Silver Mines, Limited, was incorporated on October 12, 1917, with an authorized capital of \$1,500,000 in shares of \$1.00 par value; about 1,000,000 shares have been issued. The officers are: J. C. Houston, president; J. Walter Young, secretary; J. J. Bourne, manager. The head office is Haileybury, Ont. The property of the company is in lot 2, concession II, Cane township.

Work was carried on from August 9 to December 10. Comfortable camps, providing accommodation for 40 men, were built in the last month and a half. The buildings consist of: a three-story bunkhouse, 28 feet by 30 feet, a cookhouse and storehouse, 24 feet by 40 feet, a two-story office building, 24 feet by 28 feet, an ice house, 12 feet by 16 feet, a magazine, 10 feet by 14 feet, and a barn, 16 feet by 30 feet. Two miles of new road were built on high ground to connect with the wagon road from Kenabeek station, thereby shortening the route to the property by a mile and a half.

For the first two months open-cut work was done on veins 1, 2, and 8.

It was then decided to confine efforts to sinking on vein No. 8; a shaft, 6 feet by 10½ feet, on this vein had reached a depth of 40 feet when the shut-down occurred. Up to October, 1, 100 sacks of ore, weighing 3½ tons and assaying 402 ounces of silver per ton, were shipped from the open cuts to the Cobalt Reduction Company, and at the time of closing 75 sacks more were ready for shipment.

Castle.—The Trethewey Silver-Cobalt Mine, Limited, owns and operates the Castle mine at Gowganda, comprising a group of mining claims between Miller and Everett lakes in the townships of Nicol and Haultain. J. P. Bickell is president of the company, and Murray Kennedy is manager. An average of 40 men is employed.

Development work for the year has been fairly successful. A total of 1,020 feet of drifts and crosscuts were driven. The incline shaft was continued from the 100 to the 150-foot level, and a 40-foot stope opened to the south of the shaft between these levels. On the 100-foot 790 feet of drifting and crosscutting were done, and on the lower level, 70 feet.

A new vein, which has been named the "Office" vein, was discovered during the year; this runs nearly at right angles to the vein first discovered. A vertical shaft was sunk on this vein to a depth of 82 feet and 160 feet of lateral work done on the 70-foot level. Five shipments, amounting to 46 tons and containing 63,000 ounces, were made during the year.

Collins.—F. Howard Collins resumed work on his claim T.C. 220 (2947) on the west side of Leroy lake in June, 1920, with a force of 14 men. Crosscuts were driven $38\frac{1}{2}$ feet west and 27 feet east on the 200-foot level. After two weeks' operation, the air compressor, which was procured for this work broke down and work was suspended for two months. In September another start was made and the shaft sunk to a depth of 300 feet. Work was discontinued on December 8.

Miller Lake O'Brien.—This mine at Gowganda is owned and operated by M. J. O'Brien, Limited. J. G. Dickenson, Cobalt, is manager and H. G. Kennedy, Gowganda, resident superintendent.

During 1920 the underground work done consisted of: drifting and cross-cutting, 1,581 feet; raising, 110 feet; ore broken, 26,302 tons, of which 18,633 tons were broken in stopes. Owing to a shortage of power in the latter part of the year, the mill was closed for three months. The employees numbered 82.

Miller Lake Silver Star.—The Miller Lake Silver Star Mines, Limited, carried on work on the Hart claim near Miller lake from January 24 to October 15, 1920.

After camps had been built and machinery set up, underground work was started on August 1 and continued until the shut-down in October; a few hundred feet of driving were done on the 100-foot level. The machinery consists of: an 80-h.p. locomotive-type boiler, a 25-h.p. vertical boiler, a 500-c.f. Ingersoll air compressor, and a 6-inch by 8-inch Rand hoist.

The head office of the company is at 99 St. James Street, Montreal, at the office of Robert T. Mullin, the vice-president. J. A. Montague was manager until October, when J. J. Trickey of Montreal took charge. There were 15 men employed.

Northcliff.—Northcliff Mines, Limited, continued the adit on its property to a distance of 230 feet. A force of eight men was employed until August 1, when the work was stopped. Norman E. Dye was manager.

Regent.—The Regent Mines, Limited, (authorized capital, \$1,000,000 in shares of \$1.00 par value), owns 80 acres in lot 1, concessions III and IV of the township of James. The officers are: William Dougherty, Sarnia, president; Dr. Pinard, London, Ont., vice-president; John Hale, Sarnia Paper Box Co., Sarnia, Ont., secretary-treasurer.

The company began work on July 1. Camps and a small power-house were built; and two vertical boilers of about 18 and 20 horsepower, and a 5-inch by 7-inch Napance hoist were provided. An incline shaft was started in September and was 30 feet deep when work was stopped on December 19.

Reeve-Dobie.—Reeve-Dobie Mines, Limited, did some 200 feet of cross-cutting on the 200-foot level and shut down the mine on September 8, 1920. From 15 to 20 men were employed under managing director M. H. Jacobs.

Rominco.—Rominco Mines Company, Limited, had seven men doing surface work on the Big Four property at Gowganda until the buildings were destroyed by fire on July 6. Three men were engaged in building a camp during August.

The company is capitalized at \$1,500,000 in shares of \$1.00 par value. The officers are: Dr. Carl A. Huber, New York, president; L. A. Chittenden, Messina, N. Y., vice-president; James J. Withal, 123 Central Building, Rochester, N. Y., secretary-treasurer.

Silver Bullion.—The Silver Bullion Mines, Limited, carried on work at its property at Leroy lake during a portion of the year. After setting up a mining plant, consisting of a 100-h.p. locomotive-type boiler, a six-drill cross-compound Ingersoll-Rand air compressor, and a 6-inch by 8-inch Jenckes hoisting engine, an incline shaft was sunk to a depth of 52 feet on the Dodds vein and 50 feet of drifting were done on the 75-foot level of the Island shaft.

The directors of the company are: Senator W. H. Sharp, Manitou, Mar., president; Senator E. L. Girroir, Ottawa, secretary-treasurer; H. A. Frank, Millerton, N. B., managing director; J. Robinson; and John Walsh.

Triangle.—Triangle Silver Mines, Limited, continued to work its property in Auld township until the end of November, 1920. Driving was done on the 130-foot and 182-foot levels, and the incline shaft between these two levels was straightened. W. H. Jeffery, the manager, had 15 to 20 men employed.

Walsh.—Walsh Mines, Limited, incorporated on November 4, 1912, with a capital of \$100,000 owns mining claims M.R. 1250, 1251, and 1252, and G.G. 3879. The company carried on work from March 25 to July 14 from a shaft 185 feet deep, on the south shore of Miller lake, and did 550 feet of drifting on the 185-foot level, making the total lateral work done on that level to date about 850 feet. Twenty men were employed.

The machinery comprises a three-drill compressor and an 8-inch by 10-inch Lidgerwood hoist.

The board of directors for this company is the same as that for the Silver Bullion Mines, Limited. Albert Terrill was manager.

White Reserve.—The White Reserve Mining Company, Limited, had twelve men employed during the summer at its mine in Whitson township, near Maple mountain. Work was stopped on September 13, when an option was given to English capitalists represented by J. B. Tyrrell. Mr. Tyrrell intends to do some diamond drilling.

The shafts at this mine were enumerated in the Twenty-Seventh Annual Report of the Bureau of Mines.

J. A. McAndrew, 408 Lumsden Building, Toronto, is president and general manager of the company.

IV. Southern and Eastern Ontario

Celestite

Wilder.—A celestite mine was worked near Calabogie in 1920. For some time it has been known that this mineral occurs on lot 7, concession X, Bagot township, but no exploitation was attempted until 1919, when the mineral rights to 400 acres were purchased from the Estate of Hiram Robinson, Ottawa, by James E. Wilder, a Montreal merchant. The surface rights are owned by Cyrus Holden.

Mr. Wilder began work on October 1, 1919, at a point a quarter of a mile west of Virgin lake (or Dempsey lake, as it is locally known), and has since built a grinding plant near the pit. When inspected on October 14, 1920, the excavation was 60 feet in length and had a width of 50 feet at one end and 25 feet at the other; its greatest depth was 25 feet. A good showing of celestite was exposed at the bottom of the south face of the pit, but, as the footwall was not visible, it was not possible to determine the thickness; it was, however, at least six feet thick at this horizon. The dip of the deposit, which is vein-like, appeared to be at 45 degrees to the south. The celestite is white in colour, of the fibrous, radiated

habit, and is associated with a little barite; Mr. Bambrick, the superintendent, stated that the barite content runs from 10 to 12 per cent. There are some horses in the vein consisting of carbonate of a pale pink color; in the face seen these horses were comparatively few in number and the largest was two feet in its greatest dimension. Celestite in small quantities is exposed at several other places on the property, but not enough work has been done to determine whether these outcrops are connected with deposits of any importance. One core-drill hole was put down on the deposit first mentioned and now being worked; at 40 feet celestite was encountered and persisted to 60 feet where drilling was stopped owing to the loss of the bit. The owner intends to sink a slope from the bottom of the pit.

The celestite is crushed in a 6-inch by 8-inch Wettlaufer jaw crusher and then ground in a Sturtevant vertical rock emery mill. The fines are lifted by a fan and the remainder of the product is elevated to a bin. The next stage of the grinding is done in a Sturtevant horizontal rock emery mill which discharges into a cone and the fines from this grinding join those produced in the first mill. The product and the fines from both mills are bolted in two bolting machines, the oversize being returned to the horizontal mill. The ground celestite is all sold to paint manufacturers.

Additional machinery on the property includes: a return tubular boiler, a threshing boiler, a steam engine and a contractor's hoisting engine.

Joseph Bambrick was in charge and had eleven men employed.

Corundum

Corundum Limited.—This company operated its mill at Craigmont for six months during 1920 treating tailings leased from the Manufacturer's Corundum Company, Limited. A recovery of 2.57 tons per 100 tons tailings treated is being obtained.

The capacity of the plant has been increased from 100 to 130 tons per day, operations being carried on for 24 hours per day. Thirty-five men were employed.

The officers of the company are: president, N. C. Harrison, 209 Washington St., Boston, Mass.; general manager, E. B. Clarke, Craigmont, Ont.

Feldspar

Allan.—North Burgess township, concession X, lot 12. The deposit of feldspar on the J. K. Allan farm at Allan Mill, six miles from Perth, was tested for two months by the Silica Milling Company, Monadnock Building, Chicago. Work was stopped in February, 1920. Michael P. Powers of Perth was in charge.

Ceebe Lake.—W. B. Woods, 305 Board of Trade Building, Wheeling, W. Va., shipped 722 tons of feldspar from a vein on lot 26, concession II, township of Chapman. The vein is near Harlem's wharf on Ceebe lake, an expansion of the Maganatawan river, and is nine miles west of Burks Falls. A scow is being built to transport the feldspar to Burks Falls during the season of 1921.

Towards the end of the year, the Wheeling Feldspar Company was incorporated to exploit the property.

Dillon and Mills.—W. A. Dillon and W. A. Mills worked three feldspar quarries near Hybla, Ont., during 1920, all shipments being made to the Feldspar Milling Co., Toronto.

Two of these were on the W. H. McCormack farm. From the first on that part of lot 22, concession VI, township of Monteagle, lying west of the Central Ontario Railway, 16 cars were shipped.

The second deposit, from which 4 cars of feldspar were shipped, was on the west half, lot 24, concession VI, township of Monteagle.

The third deposit worked was on the farm of Geo. Watson, on the south half lot 21, concession VII, township of Monteagle. Six carloads of feldspar were shipped.

Ten men were employed. Early in 1921 this firm did some prospecting work on the Carfare farm, lot 5, concession XII, township of Faraday. This is about 3 miles south west of Bancroft, Ont.

P. J. Dwyer.—In March, 1921, P. J. Dwyer, 59 Yonge St., Toronto, resumed work with a force of 5 men under foreman J. McDonald, on a feldspar deposit in the farm of Harry Plunket, in lot 20, concession VI, township of Monteagle. Work consisted of stripping along 200 feet on a vein which appeared to be from 20 to 25 feet wide. A 30 h.p. vertical boiler was being put in position to supply steam for drilling.

One carload of feldspar was hauled to Hybla, a mile and a half distant, and shipped by C. N. railway.

Eureka Flint and Spar Co., Limited.—This company was one of the largest shippers of spar from Ontario in 1920.

The Emery quarry near Verona was the source of most of the supply, and was worked during the whole year. About fifteen men were employed. This quarry is in the west half of lot 16, concession XI, township of Portland.

This company also opened a new deposit of feldspar on the farm of Edward Finn, half a mile southeast of Wilkinson station on the Canadian Pacific railway. The vein is on lot 3, concession X, Hinchinbrook township. A plant, consisting of a Stroudsburg Engine Works contractor's hoist and vertical boiler, and a derrick, was set up. Shipments were made for a couple of months and work was then stopped.

The grinding works of the company are at Trenton, N. J. John Wilkes, 39 Logan Avenue, Trenton, N. J., is field manager and Richard Wagar, Verona, Ont., is foreman for both the Emery and the Finn quarries.

Feldspar Milling Co., Limited.—The feldspar-grinding plant of this company at Drafton siding near Tichborne was in operation until July, 1920. The machinery was then removed to Ashbridge bay, Toronto, where it is said to be grinding feldspar. The late F. H. Hurlburt of 33 Richmond St. West, Toronto, was president of the company.

Feldspar Quarries, Limited.—In 1920 Feldspar Quarries, Limited, carried on work at the Brebner and Timmins feldspar quarries near Verona and purchased the O'Holloran feldspar mine near Perth. The company was reorganized at the end of the year and the following officers were appointed: president and managing director, W. H. Despard, 48 Crescent Road, Toronto; treasurer, Donald A. Cameron, Toronto; secretary, Miss N. F. Martin, Toronto; manager, Gordon C. Edwards, Verona.

The Brebner quarry (also known as the "Bauder" or "Gamey") is in lot 4, concession XII, Portland township, and was worked until September 1, 1920.

The Timmins feldspar quarry is a new one in part of lots 17 and 18, concession, XI, Portland township, on the farm of John Timmins. Work was carried on from April to September, 1920, and was resumed in January, 1921. The plant consists of a Beatty and Son's contractor's hoist, two vertical boilers, a locomotive-type boiler and a derrick. At first the vein contained a high percentage of quartz but when last inspected it looked much more promising, as the quartz seemed to be pinching out. Molybdenite is conspicuous in some of the quartz. Twelve men are employed under the direction of foreman Fred Amey of Verona.

The O'Holloran (or Holloran) feldspar deposit is on the farm of Michael O'Holloran in lot 1, concession II, Bathurst township, and is a short distance south of Christie lake. Gordon C. Edwards bought the mining rights from Joseph H. Mendels of Perth and began mining in July, 1920. Mr. Edwards put in a plant consisting of a contractor's hoist and vertical boiler, a horizontal tubular boiler, a horse whim and a derrick. At the end of the year Feldspar Quarries, Limited, acquired control and continued to work the property. The feldspar is hauled two and a half miles to Elliott siding, eight miles west of Glen Tay. Eighteen men are employed under the direction of Joseph H. Mendels, superintendent, and Albert McGonegal, foreman. The post office address for the mine is R. R. No. 1, Perth, Ont.

Freeman.—Loughborough township, concession XII, lots 1 and 2, and Portland township, concession XIII, lot 1. During the summer of 1920, W. A. Mills, R.R. No. 1, Hartington, Ont., worked for a short time resorting the dumps at the Freeman feldspar mine. This property was worked in 1902 and 1903 by the Pennsylvania Feldspar Company.

Gardner Feldspar Company.—The Gardner Feldspar Company began to prospect a vein of feldspar two miles northeast of Tichborne, Ont., in the early part of 1920. This is on William Steele's farm and is on the west half of lot 27, concession III, Bedford township. Shipments were made until September, when the quarry was abandoned. Wm. McCharles was foreman and had charge of ten men.

In September the company began to exploit another new property near Holleford. This is the farm of W. J. Babcock and comprises lot 1, the west half of lot 2, and the northeast quarter of lot 2, concession XI, Loughborough, and the east half of lot 3, concession XII, Loughborough. A Beatty and Son's contractor's hoisting engine and vertical boiler and a derrick were transferred from the Steele quarry and put in use. In summer, Hartington is the nearest shipping point and a six-mile haul is necessary; in winter by using a winter road to Verona the haul may be reduced to four and a half miles. When inspection was made on November 29, eighteen men were employed. Gerald B. Emery, R.R., No. 1, Hartington, Ont., is manager and V. A. B. Abrams, foreman.

Hoppins.—Bedford township, concession III, lot 2. The International Feldspar Company, Limited, continued to work this feldspar quarry during all of 1920 and employed 15 men. John A. McLean, 316 Moffat Block, Detroit, Mich., is president of the company, and John J. Abrams is superintendent. The postal address of the quarry is R.R. No. 2, Hartington, Ont.

Long Lake.—Loughborough township, concession IX, lot 11. O'Brien and Fowler continued work until July, 1920, on the two feldspar veins mentioned in the Twenty-ninth Annual Report of the Ontario Department of Mines. The property is near Perth Road and the veins are on the shore of Long lake, Frontenac county. N. B. Davis, Union Bank Building, Ottawa, was manager.

In December, Sherman Orser and Dr. S. C. Wilson of Perth, Ont., began work on one of the veins with a force of five men. William Raymond is foreman.

McDonald.—The Verona Mining Company operated throughout the year 1920 at their quarry on the Peter McDonald farm, lot 18, concession VII, township of Montegale, and a mile and a half east of Hybla Station on the Central Ontario Railway.

The quarry was worked in four benches with faces of 12, 16, 30 and 15 feet respectively. The width of the benches varies from 30 to 60 feet and extends over a length of about 465 feet.

An average of 20 men was employed during the year. The output of the quarry varies from 25 to 45 tons a day, and is shipped via Hybla to Rochester, N.Y.

The officers of the company are: president, S. Harry Worth, Philadelphia, Pa.; secretary-treasurer, M. Moore, Philadelphia, Pa.; general manager, G. Vaughan Baker, Philadelphia, Pa.; superintendent of quarries, Robt. J. Elliot, Hybla, Ont.

The head office of the Company is at 404 Harrison Building, Philadelphia, Pa.

The Sutherland quarry (on farm of Alex. Sutherland), in lot 19, concession VII, township of Monteagle, was worked for a short time during 1920. The vein here is about 30 feet wide and has been opened up over a length of 50 feet and a depth of 12 feet.

McGregor.—Bedford township, concession III, lot 25. The McGregor feldspar mine near Tichborne was bought by Federal Feldspar, Limited, and was worked by this company until November, 1920. The equipment includes two Marsh and Henthorn contractor's hoists with vertical boilers, and two derricks. When the quarry was inspected in August, its dimensions were approximately 100 feet long, 25 feet wide and 6 to 25 feet deep. Fifteen men were employed under foreman William Abel. The head office of the company is at 250 Slater Street, Ottawa and the officers are: president, J. R. Douglas, Ottawa; vice-president and manager, John O'Toole, Ottawa, secretary-treasurer, Harold Fisher, Ottawa.

Morrison, Woods and Eastman.—Early in 1920, two car-loads were shipped to Hamilton from a deposit of feldspar on Chas. Lake's farm, lot 9, concession XII, township of Faraday, about three and a half miles southwest of Bancroft. The quarry face was 30 feet in depth and the opening 150 feet wide. The work was in charge of Thos. Morrison of Bancroft, the other members of the syndicate being William Woods, Hamilton, Ont., and A. M. Eastwood, Hamilton, Ont. Fifteen men were employed for three months in the early part of the year.

This syndicate prospected by stripping and sinking test pits on Sam Robinson's farm, south half of lot 5, lot 6 and 7, concession A, township of Faraday. No shipments were made.

Ontario Feldspar, Limited.—This company worked the Morrow feldspar property near Feldspar, Ont., during the early part of the year. S. H. Orser, Perth, Ont., was manager.

Orser-Kraft Feldspar, Limited.—This is a new corporation with the following officers: president and manager, Sidney H. Orser, Box 99, Perth, Ont.; vice-president, Ed. Erion, Buffalo, N. Y.; treasurer, Leo B. Seitz, Buffalo, N. Y.; secretary, Miss Dencie Orser, Perth, Ont.; directors, Harry N. Kraft and Gustav Metz, both of Buffalo, N. Y. The company is doing work on the three feldspar properties mentioned below.

Morrow.—South Sherbrooke township, concession V, lot 13. This quarry was worked throughout 1920, first by Ontario Feldspar, Limited, and later by Orser-Kraft Feldspar, Limited. Elwood Orser is superintendent and Ernest Newman, foreman. Thirteen men are employed.

Burns.—In July, 1920, this company began to work a pegmatite dike in the east half of lot 2, concession III, township of Bathurst. This dike is beside the Canadian Pacific Railway tracks but as no siding has yet been put in, shipments have to be made from Christie Lake siding a mile and a half to the east. Austin and Hawley shipped quartz from this deposit a few years ago. Orser-Kraft Feldspar, Limited, have a small crew removing a band of quartz preparatory to mining feldspar.

Keays.—In January, 1921, Orser-Kraft Feldspar, Limited, began to open a deposit of white and greenish white feldspar on the Wm. J. Keays property, northwest of Perth. This is situated on the east half of lot 21, concession IX, Bathurst township. The rock on the south side of the vein consists of gneiss, that on the north has not yet been exposed. Six men were drilling by hand under supervision of Creighton Orser. This vein is a wide one, but the seven-mile haul to Glen Tay is a handicap. Apatite was mined on an adjacent property many years ago.

Patterson.—South Sherbrooke township, concession VI, lot 15. A vein of feldspar on the farm of Robert J. Patterson was prospected in a small way by Universal Silicates, Limited, during the early part of the year. Later, L. E. Austin, who mined feldspar near Verona a few years ago, shipped several carloads from this vein.

Rinaldo McConnell.—Rinaldo McConnell of Perth, Ont., shipped feldspar from two quarries in 1920—the Palmer near Feldspar and the Kirkham near Brooke.

Palmer.—South Sherbrooke township, concession IV, lot 10. This quarry, locally known as the "Palmer", is on a farm now being worked by James Morrow. Feldspar was quarried by hand-drilling during the early part of the year and was shipped from Feldspar station a mile distant from the quarry. Six men were employed.

Kirkham.—Bathurst township, concession VII, lot 3. Stripping and preparatory work were done in 1919 and a small quantity of feldspar was shipped. In May, 1920, work was resumed. Power is supplied by a return tubular boiler, and a winch geared to a small horizontal steam engine is used for hoisting. When the quarry was inspected in February, 1921, the excavation on the vein of feldspar was 90 feet long, 22 feet deep at the deepest point, and averaged 20 feet in width. The vein strikes N. 55 E. (magnetic) and contains a good grade of red feldspar. Shipments are made from Bathurst station. The force is in charge of foreman James Benton and consists of twelve men.

The Rock Products Company.—The Rock Products Company, whose works are at Silica, Ohio, mined feldspar in 1920 from a vein on the James Truelove farm in lot 10, concession VI, Bathurst township. Work began in July and continued until the end of the year, when the pit was from 6 to 18 feet wide, 45 feet long and some 20 feet deep. A whim and derrick were used for hoisting. Fourteen carloads of feldspar were mined and shipped from Bathurst station, which is two miles away. An office and a small boarding house were built near the quarry.

In January, 1921, this company began to test another feldspar vein on the Wm. D. Noonan farm, lot 18, concession IX, Bathurst township.

A. G. Minchart, Nicholas Building, Toledo, Ohio, is treasurer and manager of the company, and W. A. Hannah, Wemyss, Ont., is field manager.

South March.—O'Brien and Fowler continued to work the deposits of feldspar near South March station until November 26, 1920. These were in lot 6, concession II and III, March township, and were mentioned in the Twenty-ninth Annual Report. Fourteen men were employed under foreman Charles C. Orser. The largest excavation is 125 feet long, 25 feet wide and 20 feet deep. Norman B. Davis, Union Bank Building, Ottawa, is manager for O'Brien and Fowler.

Spencer and Rose.—Spencer and Rose of Napanee did six weeks of prospecting work on John G. Price's farm, lot 22, concession VII. The work consisted of sinking test pits. No shipments were made. Four men were employed.

Teeples.—In January 1921, Dr. Coon of Elgin, Clarke G. Walton of Elgin and several associates began to test a large deposit of white feldspar on the Alexander Teeples property. The vein, which is in crystalline limestone, is on the east side of Upper Rock lake in lot 8, concession XIII of the township of Storrington. A trial shipment was made from Buck Lake Siding.

Universal Silicates, Limited.—Work was carried on during 1920 by this company on three feldspar deposits on the Geo. Watson farm.

That on the southern part of lot 22, concession VI, township of Montegale, was worked for three months, beginning in March, 1920. A steam plant used here consisted of a 60-h.p. boiler furnishing steam for a Jenckes hoist, drills and pumps.

Another pit on the northern part of the same lot was opened over a width of 20 feet, 60 feet in length and 35 feet deep.

A third deposit worked on the Geo. Watson farm was located on the western part of lot 21 in the same concession.

12 cars of feldspar were shipped from Hybla Station. An average of nine men was employed.

None of these properties were working at the end of 1920. The holdings of the company are said to have been sold to the American Molybdenites, Limited.

Fluorite

Noyes.—The Canadian Industrial Minerals, Limited, continued work on the Noyes mine near Madoc (lot 13, concession XII, township of Huntingdon), until October 5, 1920, when the mine was closed and all machinery removed.

Drifting was done on the 200-ft level for a distance of 85 feet. At the north-west end of this drift a raise was made to connect with the No. 2 shaft at the 100-foot level. At a distance of 93 feet S. E. from No. 2 shaft on the 200-foot level, a winze was sunk to a depth of 50 feet and on this 250-foot level drifting to the N.W. for a distance of 486 feet was done. Two hundred and ten feet of raising was done on the 100-foot and 200-foot levels.

Ore was mined on the 100-foot and 200-foot levels and 2,528.43 short tons of fluorite were shipped. Of this, 2,202.95 tons were sold to consumers in the United States of America, the remainder being sold in Canada.

Forty men were employed, and R. C. Bryden, Madoc, was manager. The head office of the company is 1511-1520, Bank of Hamilton Building, Toronto, Ontario.

Perry.—Cross and Wellington worked the Perry mine on lot 11, concession XIII, Huntingdon township near Madoc, during 1920 with the exception of one month at the beginning of the year. The work consisted chiefly in drifting 110 feet to the southeast (now 170 feet from No. 3 shaft) and in stoping above the 148-foot level. Shipments totalled 1,174 tons, principally to foundries and steel works at Hamilton.

Sixteen men were employed during the year. Henry C. Lloyd was in charge.

Gold

Golden Fleece.—The Cobalt Frontenac Mining Company, Limited, carried on underground development during six months of the year at the Golden Fleece mine, near Flinton. The work of installing the machinery in the new cyanide plant was also continued.

The incline shaft, at an angle of 70 degrees is 100 feet deep. The underground work during the year consisted of about 160 feet of drifting, 220 feet of cross-cutting and a raise of 65 feet.

A new unit was installed in the power plant on the Skootamatta river at Flinton, consisting of a turbine and generator of 312-k.v.a., which will be required for the new cyanide mill. Fifteen men were employed during the year.

The officers of the company are: D. H. Fletcher, manager, Flinton; V. A. Burke, secretary-treasurer, Toronto.

Graphite

Black Donald.—The Black Donald graphite mine was inspected on October 13, 1920, when a force of 50 men was employed. Stopping was then being done above the 75-foot level west of the skipway.

In October, 1919, the flow-sheet of the mill was changed and three Callow cells—one roughing and two finishing—were put in use.

In 1920 a two story saw-mill, 24 feet by 62 feet, was built. This contains a 48-inch saw and a planer, driven by a Westinghouse motor.

The mine is owned by Black Donald Graphite Company, Limited, whose head office is at Calabogie, Ont. The officers of the company are: president and treasurer, R. F. Bunting; secretary, J. N. Snead; superintendent, John D. Patno.

Gypsum

Ontario Gypsum Company, Limited.—The Ontario Gypsum Company, Limited, has an authorized capital of 7,500 shares of a par value of \$100.00, of which 6,577 have been issued. The officials of the company are: president, Whitney G. Case, Buffalo; secretary-treasurer, Robert E. Haire, Paris, Ontario. In addition the following are directors: O. W. Whitby, Paris, Jas. R. Inksater, Paris, and C. E. Williams, Chicago. R. E. Haire, Paris, is general manager; A. J. Parkhurst, Caledonia, is superintendent; John Renwick is mine foreman at Caledonia and W. A. Parkhurst in charge at Lythmore. The head office is at Paris, Ontario, and the gypsum mines and plaster mills are at Caledonia and Lythmore. An average of 175 men was employed during the year.

An additional 30 acres was bought at Caledonia, lying on the east side of the property and north of the Calinhan lot. The Caledonia holdings now amount to 375 acres. This mine was in continuous operation during 1920 and 84,000 tons of gypsum were hoisted.

An addition was made to the wallboard plant. This was originally the Canada Plaster Board Company, Limited, and was taken over by the Ontario Gypsum Company in December, 1919. In a building 550 feet long, 28 feet wide and 12 feet high, with a grade of 1%, is installed a travelling belt 530 feet long to take the wall board from the mixing and shaping machine, also an automatic cutter and drying kilns. The plant has a capacity of 300,000 square feet per week. The wall board is simply plaster of paris and wood fibre with a heavy paper surfacing and is supplied in length from 4 feet to 10 feet and sold under the trade name of "Gyproc." Gypsum boards 32 inches by 36 inches are also manufactured on this machine. These are used instead of lath by the builders and are plastered upon, and are put on the market as "Gypsum Boards."

At Lythmore the shaft was sunk to the first bed of gypsum at 91 feet and is being continued to 125 feet to open up the second bed. A station and pumping chamber was cut on the first bed of gypsum, which is 11 feet thick. The second bed of gypsum is 4 feet, 6 inches in thickness and is an exceptionally white gypsum. It is expected that this gypsum can be used instead of the white rock now imported by the company from Nova Scotia.

The mill was in operation 4 months on gypsum shipped from the mine at Caledonia.

Iron Pyrites

Grasselli.—The Grasselli Chemical Company, Limited, operated their mine situated a mile and a half northeast of Clyde Lake siding on the Kingston and Pembroke railway until Sept. 26, 1920, when work was stopped. Clyde Lake siding is at railway mileage 22.5 south from Renfrew.

During 1920, the main or No. 2 shaft was sunk an additional 35 feet. Drifting for a distance of 150 feet to the east and 110 feet to the west together with 120 feet of raising was done on the first level, and 25 feet of drifting was done on the second level.

The tonnage of 991 gross tons of run of mine ore was shipped to the company's plant at Hamilton, Ont.

An average of 39 men was employed. D. S. Tovey, Flower Station, was superintendent.

Nicholls Chemical Company.—The mine and plant at Sulphide operated throughout the year 1920, manufacturing sulphuric, nitric and hydrochloric acids, nitre and salt cake. Ore used was taken from stopes over the 2nd, 3rd, 4th and 6th levels.

In January 1921 a winze at incline of 60 degrees was started from the 6th (575 ft.) level 80 ft. east of the main shaft and was sunk to a depth of 100 ft. Plans were under way for cross-cutting the veins at the new level and for carrying on further prospecting by diamond drilling.

The officers of the company are: president, C. W. Nichols, New York; general manager, A. Neighorn, 222 St. James St., Montreal, Que.; secretary, Thos. F. Burgess, New York; treasurer, James L. Morgan, New York; superintendent, W. H. De Blois, Sulphide, Ont.

One hundred and fifty men were employed in the mine and plant.

Lead

Frontenac.—Kingston Smelting and Refining Company, Limited, capitalized at \$1,000,000 has been incorporated to work the Frontenac lead mine near Perth Road but as yet has done only some repair work at the mine. The mine property consists of the south half of lot 16 and part of lot 15, concession IX, and the south half of lot 14, concession X, Loughborough township.

The officers are: president, Dr. E. D. Chaplin, New York; 1st vice-president and manager, Alex. McKimmon, Kingston, Ont; 2nd vice-president, S. V. Gavito, New York; director, J. Pina, New York; secretary, J. M. Israel, New York. The head office is in Kingston, Ont.

Kingdon.—The lead mine, concentrator and smelter of the Kingdon Mining, Smelting and Manufacturing Company, Limited, at Galetta was operated throughout 1920 though intermittently during the first six months of the year.

The main shaft was continued to a depth of 418 ft. and a level made at the 400 ft. depth. Drifts were run 278 ft. east and 276 ft. west from the shaft on this level. On the 3rd level (313 ft.) drifts were continued to a distance of 416 ft. east and 485 ft. west from the main shaft.

Stoping was carried on above the 3rd and 4th levels and ore withdrawn from the stopes above the 1st and 2nd levels.

An electric driven 550 volt 3 stage centrifugal pump with capacity of 300 gals. per min. was installed at the 400-foot level during the early part of the year.

During the year the mill treated 26,334 tons of ore yielding 1,572.95 tons of galena concentrates. There were 150 tons of zinc concentrates containing 44.5 per cent zinc shipped in 1919 to the Grasselli Chemical Co. at Cleveland, Ohio.

At the smelter, the 10-ton refining kettle was replaced by one of thirty ton capacity. A quantity of 1140.73 tons refined lead was produced during the year and the grey slag from the Scotch hearth was stored for further treatment.

All machinery on the property except haulage from mill to smelter is electrically driven. Power is obtainable from the Galetta Electric Power and Milling Co., Ltd., whose generating station is on the Mississippi river about $1\frac{1}{2}$ miles from the mine. This power is transmitted at 2200 volts and is transformed at the mine to 550 volts.

During the year a new dry house was erected near the main shaft and six dwelling houses were erected for employees. A. G. Munich, 314 Beaver Hall Hill, Montreal, Que. is managing director and C. H. Thompson, Galetta, Ont. is superintendent of works employing 105 men.

Murphy.—In the Twenty-ninth Annual Report of the Bureau, mention was made of a galena prospect, locally known as the "Murphy lead mine," in Bedford township, county of Frontenac. This is on the south half of lot 17, concession VI.

McLaurin Development Company, Limited, was incorporated on November 21, 1919, with an authorized capital of \$50,000 to work this prospect. The officers are: president, J. D. McLaurin, South Orange, N. J.; manager, M. W. Wambaugh, 616 Eastgate Avenue, St. Louis, Mo.; superintendent, Conrad Koehler, Godfrey, Ont.

When inspection was made on July 29, 1920, a vertical shaft had been sunk to a depth of 40 feet, but only the collar had been timbered. This shaft is on a vein of calcite through part of which galena is disseminated. The wall rock is crystalline limestone. The following machinery was set up in June, a Marsh and Henthorn hoisting engine, a 20-h. p. crude oil engine ("Munktell's motor") and a Sullivan 8-inch by 8-inch air compressor. Six men were employed until August 10, 1920, when all work was stopped.

Marble

Pontiac.—In May, 1920, Pontiac Marble and Lime Company, Limited, started a new quarry on the farm of Arthur Gould, in lot 20, concession V, Ross township. The stone is a coarse-grained white marble and is being sold to George Froats and Company, Renfrew, Ont., for monuments. Haleys, a Canadian Pacific station, three and a half miles distant from the quarry, is the nearest shipping point. Wesley N. Dawley of 381 Lisgar Street, Ottawa, the vice-president of the company and a stone-cutter by trade, is in charge of the quarry. When inspection was made on October 15, four men were employed.

Mica

Aylen Lake.—Mica was produced during part of 1920 from a vein near the north end of Aylen lake in lot 9, concession XIII, Dickens township, and about a mile south of the Algonquin Park boundary. The property may be reached by walking a mile and a half from Opeongo station on the Canada Atlantic division of the Canadian National Railways to the south end of Aylen lake, and thence taking a boat to the mine.

Opeongo Mica Mines, Limited, of which company Thomas A. Low, Renfrew, Ont., is president and manager, began work on the vein in November, 1919, under an option to purchase and built a comfortable camp and office on the shore of the lake.

The property was inspected on May 26, 1920, and up to that date 160 barrels of rough-cobbed muscovite had been shipped. This was obtained from two pits, 125 feet apart, neither of which was more than 18 feet deep. The vein is a pegma-

tite in a biotite-gneiss and in the pits is from 12 to 14 feet in thickness. It has a dip to the west varying from 10 to 30 degrees. In the autumn, work was stopped as the venture was no longer paying. Charles A. Prudhomme of Ottawa was in charge of the work and had a force of sixteen men employed.

As there are many pegmatite veins near Aylen lake, very few of which have been prospected, the district seems well worthy of the prospector's attention. Feldspar might be shipped from some of these veins if freight rates permitted.

Coombs.—A small quantity of mica was mined by "The Coombs Mines" at the north end of Otty lake, three miles southeast of Perth, Ont. This was obtained in the north half of lot 25, concession VIII, Elmsley North; the surface rights until recently belonged to James Oliver but are now owned by Roy Darou. Prospecting was started in October, 1920, and several pits were sunk on mica-apatite pyroxene occurrences.

Inspection was made in February, 1921, when five men were engaged in cutting timber, but no mining was being done. The deepest working was a pit, filled with water and said to be 50 feet deep, on the shore of a creek.

H. L. Coombs, president of H. L. Coombs Co., Limited, Dominion Express Building, Montreal, is behind the venture, and H. G. Wildman, R. R. No. 5, Perth, Ont., is supervising the work.

Ess Creek.—The Standard Mica Company of Chicago stopped work in March on the pegmatite vein near Ess Creek station, 25 miles east of Capreol. This claim was being exploited for muscovite and was mentioned in the Twenty-eighth and Twenty-ninth Annual Reports of the Ontario Bureau of Mines.

Lacey.—The Lacey mica mine, near Sydenham, in lot 11, concession VII, Loughborough township, was worked throughout the year by the Loughborough Mining Company, Limited. This mine still yields large quantities of high-grade phlogopite of both the amber and milky varieties. George W. McNaughton, Sydenham, Ont., is manager, Richard Smith superintendent, and Thomas Stevenson foreman.

Orser Mica Company.—The Orser Mica Company, of which Sidney H. Orser of Perth, Ont., is manager, worked intermittently until August, 1920, on two mica properties under lease—the Bedford, or Folger mine and the Connors and Daly mine.

The Bedford mine is near Glendower in lot 5, concession II, Bedford township and was described in the Twenty-ninth Annual Report. Frank J. Judge was foreman.

The Connors and Daly mine is near the west end of Devil lake in lot 6, concession VIII, Bedford township. Several of the numerous pits on this property were cleaned out and a few barrels of dark amber mica were shipped. There is no machinery at this mine. James Campbell was foreman.

Taggart.—The Taggart mica mine is owned by Kent Bros. and Stoness, Kingston, Ont., and has been worked by this firm since 1903. It is situated on the south side of Mud bay, Bobs lake, and is in lot 30 or lot 31, concession VI, Bedford township.

A large number of narrow parallel veins, striking northeast and southwest, have been found, and on these veins nine pits, more than 30 feet deep, have been excavated. In 1919, two pits, known as the Taggart and the Jones pits, were worked; in 1920, mining was confined to the Taggart pit. The Jones pit is 75 feet long and 100 feet deep; the Taggart pit, when inspected in August, 1920, was 60 feet long, 90 feet deep and averaged 5 feet in width. The mica obtained is of

the amber variety and after rough-cobbing is shipped from Crow lake station to Kingston for trimming. The mine machinery consists of a small marine boiler, an 80-h.p. locomotive-type boiler and an Ingersoll Rock Drill Company hoist. Eight men were employed at the time of inspection under the direction of superintendent Charles A. Stoness and foreman John A. Badour. The nearest post office is Crow Lake.

Tett.—Steve Bennett, of Westport Ont., worked the Tett mica mine under lease for a short time in 1920. It is the property of J. P. Tett and Bro. of Bedford Mills, Ont., and is in lot 24, concession VIII, Bedford township.

Phosphate

Silver Queen.—The Silver Queen phosphate and mica mine in lot 13, concession V, township of North Burgess was closed down in the spring of 1920. It was being worked by the Dominion Improvement and Development Company as mentioned in the Twenty-ninth Annual Report of this Department.

Talc

Connolly.—The Anglo-American Talc Corporation, Limited, operated the Connolly talc mine near Madoc for 250 days in 1920 and employed 25 men, 16 of these being in the mill.

The Connolly is the N.W. $\frac{1}{2}$ of lot 15, concession XIV, Huntingdon township.

Stoping was done between first and second levels and between second and third levels. About 6,000 tons of talc were produced. During the year a Canadian Check Rand compressor-16 x 18 x 16, type P. L. B., 2—capacity 783 cubic feet, was installed to supply air for the mine. This is driven by a 100-h.p. motor (Canadian General Electric). In the mill a second tube mill 6' x 24' was added.

The officers of the company elected in August, 1920, were: president, Victor Crawford, 120 Broadway, New York; vice-president, H. S. Predmore, Madoc, Ont., secretary, F. L. Deutsch, 120 Broadway, New York; superintendent, Thos. Carswell, Madoc.

On March 1, 1921, the name of the company was changed to the Asbestos Pulp Co.

Eldorado.—The Eldorado Mining and Milling Company, Limited, operated during 1920 until the middle of October.

Chas. Brent was manager and Robt. M. Phillips, superintendent. Thirty-five men were employed in the mine and mill.

George H. Gillespie and Company.—The talc mill at Madoc was in continuous operation in 1920 until the latter part of December and employed 22 men.

George H. Gillespie is manager and L. A. Ashley, mill superintendent.

Henderson.—The talc mine of the Henderson Mines, Limited, at Madoc operated during the year 1920 until Dec. 24, with a force of 14 men. All the talc was mined above the 200-foot level and was hauled to the George H. Gillespie & Company's mill at Madoc Station.

A new shaft was sunk 240 feet in the south wall between Nos. 1 and 2 shafts. Crosscutting, 40 feet, was done from the shaft in the direction of the ore body. When completed, this will form the main working shaft for the mine.

Edward Phillips is superintendent.

Price.—In the fall of 1920, a test pit about 20 feet deep was sunk on the Price lot directly east of the Connolly on what was said to be an extension of the Connolly vein.

QUARRIES, CLAY AND GRAVEL PITS

Granite and Syenite

Appleby and Hutcheon.—Mark Appleby and Andrew Hutcheon, two Gananoque quarrymen, got out paving blocks during the summer of 1920 on the John Carey farm, a short distance south of Findley station. This farm is in lot 31, concession IV, township of Pittsburgh. The rock is a red granite.

Alex. C. Brown.—Alex. C. Brown of Lyndhurst has been operating a quarry on the Alex. Bruce farm in lot 10, concession IX, Leeds township. Red granite monument stone is produced and hauled $7\frac{1}{2}$ miles to Lyndhurst for shipment. The quarry was started in the fall of 1918. Eight men were employed when the quarry was inspected on August 13, 1920. The blocks of stone were being hoisted by means of a horse whim and a hand winch.

Robert Brown.—West of the A. C. Brown granite quarry is another being worked by Robert Brown of 376 Sparks Street, Ottawa. This stone is also red granite and is shipped rough from Lyndhurst to be made into caps, dies and bases for monuments. The quarry is on the Clifford Earle farm in lots 9 and 10, concession IX, Leeds township; it was opened some thirteen years ago by Alex. Bruce and A. E. Gordon. When inspected in August, 1920, there were four men employed under foreman Harvey C. Lester of Lyndhurst. The plant consisted of three derricks, a Canadian Ingersoll Rand 8-inch by 8-inch compressor, and a Goold, Shapley and Muir Company gas engine.

Butler.—In 1916 Wm. Horne opened a quarry at Butler siding, nine miles west of Ignace and since that has carried on work every summer. Monument stone, paving blocks and dimension stone are produced. The rock is a granite varying from light gray to almost white in color. About ten men are employed. Mr. Horne's address is Ignace, Ont., or Suite 31, Ross Apartments, corner Home and Preston Streets, Winnipeg.

David J. Gordon.—For the past three years David J. Gordon of Gananoque has been quarrying monument stone from the farm of Joseph Marshall, lot 3, concession V, Leeds township. When inspected on August, 1920, four men were employed and the hoisting was being done by means of a Beatty and Sons horse whim. The rock is a greenish gray syenite. Shipments are made from Cheeseboro station on the Grand Trunk, five miles distant from the quarry.

Street and O'Brien.—The firm of Street and O'Brien (William Street and Kennedy O'Brien), Box 73, Gananoque, Ont., have been quarrying near Gananoque for some years. At the present time they are producing paving blocks and some dimension stone from a quarry which was opened some twelve years ago on the farm of James Bell, in lot 6, concession II, Leeds township. The rock is a granite, gray and red in colour. Shipments are made from Cheeseboro station, which is about a mile east of the quarry. Eight men are employed.

Silica Sand

Jordan.—In 1920 silica sand was obtained from the south shore of Christie lake on the farm of John Jordan. It was shipped from Elliott siding to Montreal by J. C. Fowle of Montreal.



Ontario Rock Co.'s trap-rock quarry near Havelock, Ontario.
The view shows a 60-foot quarry face before explosion on April 29th, 1921.
Entrances of two blasting adits are shown at base.

Trap

Ontario Rock.—The Ontario Rock Company operated its trap rock quarry near Havelock from January to December, 1920, and shipped 42,000 tons of trap rock. Shipments were curtailed owing to lack of railway cars. Additions to the plant include a 48-inch by 60-inch jaw crusher, a 48-inch belt conveyor, a 6-foot by 16-foot revolving screen, a Model 61 Marion shovel, two dinkeys and six yard cars. The plant has been electrified and is now using 600-h.p. obtained from the Hydro. A new quarry face has been opened up on a level with the jaw crushers.

The officers of the company are: Alex. Longwell, president, Toronto; G. W. Rayner, vice-president and general manager, Toronto; W. W. Wallace, superintendent, Preveaux.



General view of crushing plant and quarry, showing explosion.



Quarry after explosion in which 26,000 cubic yards of trap rock was broken in one blast by the use of 240 cases of 60 per cent dynamite and 120 cases of black powder.

Limestone

American Cyanamid.—The American Cyanamid Company began operating a quarry on December 1, 1920, on a property leased from the Beachville White Lime Company on lot 16, concession III, township of North Oxford.

The quarry has a face of 21 feet. The plant consists of 1 cyclone drill, 1 boiler, of 45-h.p., 1 derriek hoist, and 2 pumps, 3-inch and 5-inch. The material is loaded directly into cars and shipped to the company's plant at Niagara Falls, Ont. An average of 22 men are employed.

The officers of the company are: E. D. Hallam, manager, Niagara Falls, Ont.; A. J. Kennedy, superintendent, Beachville.

Beachville White Lime Co.—The limestone quarry at Beachville was operated continuously throughout the year. The quarry has a face of about 38 feet and work was started to descend to a depth of 50 feet.

The annual production amounted to 95,000 tons of stone and 3,180 tons of white lime. The stone was shipped to the Steel Company of Canada, Hamilton, to be used as a flux, to the American Cyanamid Company at Niagara Falls, and to sugar refineries. An average of 47 men was employed.

The officers of the company are: M. S. Shell, president; C. E. Downing, manager; J. H. Blow, secretary-treasurer.

Britnell and Company, Limited.—The quarry at Burnt River, Ont., was operated by this company from April 12 to November 30 in 1920. The work was carried on in two benches, the upper on a bluish limestone 13-foot face and the lower on a reddish limestone 11-foot face. Output consisted entirely of crushed rock, shipments being made by G. T. R. The quarry lies directly west of the Lindsay-Haliburton line.

An average of 18 men was employed. Wm. Britnell was manager at the quarry and Robt. Craig foreman.

Brunner Mond Canada, Limited.—This company operated the quarry and crushing plant near Amherstburg (lots 6, 7, 8, concession I and lots 2 and 3, concession II, township of Anderdon) continuously throughout the year 1920. The property was formerly owned by T. B. White.

The quarry is worked on two benches, so that stone from two limestone beds is taken out. The lower bed owing to the higher calcium content supplies the more desirable stone for the company's alkali works and it is principally for this stone, locally spoken of as "soda stone," that the quarry is operated. The lower bed is 26 feet deep and the upper bed varies between 18 and 35 feet.

The overburden on the rock is removed by a Marion steam shovel, model 28. Drilling for deep holes is done by means of well drills driven by electric power. Rotary pluggers are used for block holing. Air for the latter drills is supplied by an Ingersoll Rand 10 x 10 air compressor driven by a 35-h.p. Crocker Wheeler a. c. motor, 440 volts.

The broken rock in the quarry is loaded into 7-ton side-dump cars by a Marion steam shovel, model 61. The cars are then hauled by a locomotive (Shay type) from the quarry face to the foot of an incline leading to the crushing plant. Each car is then hauled up this incline (20% grade); by a hoist driven by a 112-h.p. motor.

The car is dumped by an air lift and rock is fed directly into a No. 11 McCully gyratory crusher, which is driven by a 100-h.p. motor. From this crusher, the stone passes to a bucket elevator, which raises it to two sets of sizing screens, each with three sections—2-1, 1- $\frac{1}{2}$, $\frac{1}{2}$ -dust. Screens and elevator are driven by a 50-h.p. motor.

Owing to requirements of the alkali plant, the stone from the two beds of the quarry is crushed separately. Everything in size from six inches to one inch from the lower bed is sent to the alkali plant to be calcined. Anything under one inch, is passed on after crushing to be mixed with the crushed stone from the upper bed.

After screening, the crushed stone is conveyed to bins from which it is loaded into railroad cars. The company has its own switching service for rock used in the alkali plant, which is a mile west of the quarry.

The crushing capacity of the plant for commercial stone can be materially increased, as a No. 7 $\frac{1}{2}$ McCully gyratory crusher and screens have been installed. This unit can be used to crush oversize from the other sets of screens, but was not in continuous operation during the year.

The output of the plant in 1920 was 500 tons a day. Thirty-five men were employed in the quarry and crushing plant.

The officials of the company are: G. N. Comly, manager; J. C. Garrels, assistant manager; W. H. Clarey, chief engineer and Jas. J. Meehan, superintendent, of quarry and crushing plant. Offices are at the alkali plant near Amherstburg Ont.

Canada Cement Company, Limited, Plant No. 8.—The cement plant at Port Colborne was operated at full capacity during the year 1920. The quarry is situated on the north side of the Grand Trunk railway and has a working face of about 18 feet. A new quarry was also opened up on the opposite side of the railway and will have a face of about the same height. During the year 130,000 tons of stone and 20,000 tons of clay were delivered to the plant.

The equipment consists of two Marion shovels and two cyclone drills in the quarries and one locomotive crane with a 1-yard orange-peel bucket used in stripping. A new McNyler Whirley steam shovel was purchased for use in the clay pit. The material is hauled to the plant by three locomotives.

A new plant for the recovery of potash was completed and put into operation about December 15. The dust from the four kiln stacks is drawn by one large fan into two duplicate chambers. The dust is precipitated by fifty sprays of water in each chamber.

An average of 25 men was employed in the quarry and clay pit.

L. M. McDonald is superintendent.

Canada Crushed Stone Corporation, Limited.—The quarry at Dundas was operated during the year with greatly increased capacity. The shortage of railway cars at the time of greatest demand, however, considerably curtailed shipments.

The quarry is about 1,100 feet in length, varies in width from 200 to 450 feet, and is worked in three benches. The upper bench has a face of 35 feet, the material from which is delivered to blast furnaces for fluxing. The two lower benches, each with a face of 20 feet, are quarried and the rock crushed for concrete and road building. The drilling is done by ten electric cyclone drills and material loaded into cars by three steam shovels. An electrically driven shovel is also used for stripping. The material is hauled to the plant by six locomotives and crushed first by a No. 10 McCully gyratory crusher driven by a 250-h.p. motor. From the first crusher it is conveyed to two 76-inch crushers which reduce it to commercial size. It is then conveyed by two thirty-inch belts to four revolving screens 48 feet by 4 feet. The oversize goes to 36-inch Garfield rolls and is again elevated to the screens. The sizes 1-inch and $\frac{1}{2}$ -inch again pass over shaking screens to complete the removal of fines. From the screening plant the rock is conveyed in bins, which have a capacity of 10,000 tons. The rock is loaded into cars from the bins or carried to the stock piles. During the year a new conveyor plant was built, which carries the crushed rock from the bins to the stock piles. A 24-inch belt carries the material 500 feet, when it is deposited on a second belt equipped with an automatic trip which deposits the rock in the piles. The conveyor has an elevation of 90 feet and 75,000 tons can be kept in stock. A concrete tunnel, 12 feet by 12 feet and 400 feet in length, runs beneath the piles. The rock is fed from chutes on to a 30-inch belt and is carried through the tunnel and elevated to bins. The material may be run through a revolving screen 4 feet by 2 feet before going to the bins. From the bins the material is loaded into cars or trucks.

The plant has now a capacity of about 60,000 tons per month and during the year a total of 450,000 tons was shipped.

The firm employed an average of 88 men.

The officers are: C. M. Doolittle, president and general manager; J. B. Hart, secretary-treasurer and assistant manager; George Gruhl superintendent.

Cayuga Stone Company.—This company started a new limestone quarry in 1920 in lot 48, concession I south, township of Cayuga North. The property consists of ten acres, is half a mile east of Nelles Corners, and across the road from a quarry owned by the county of Haldimand.

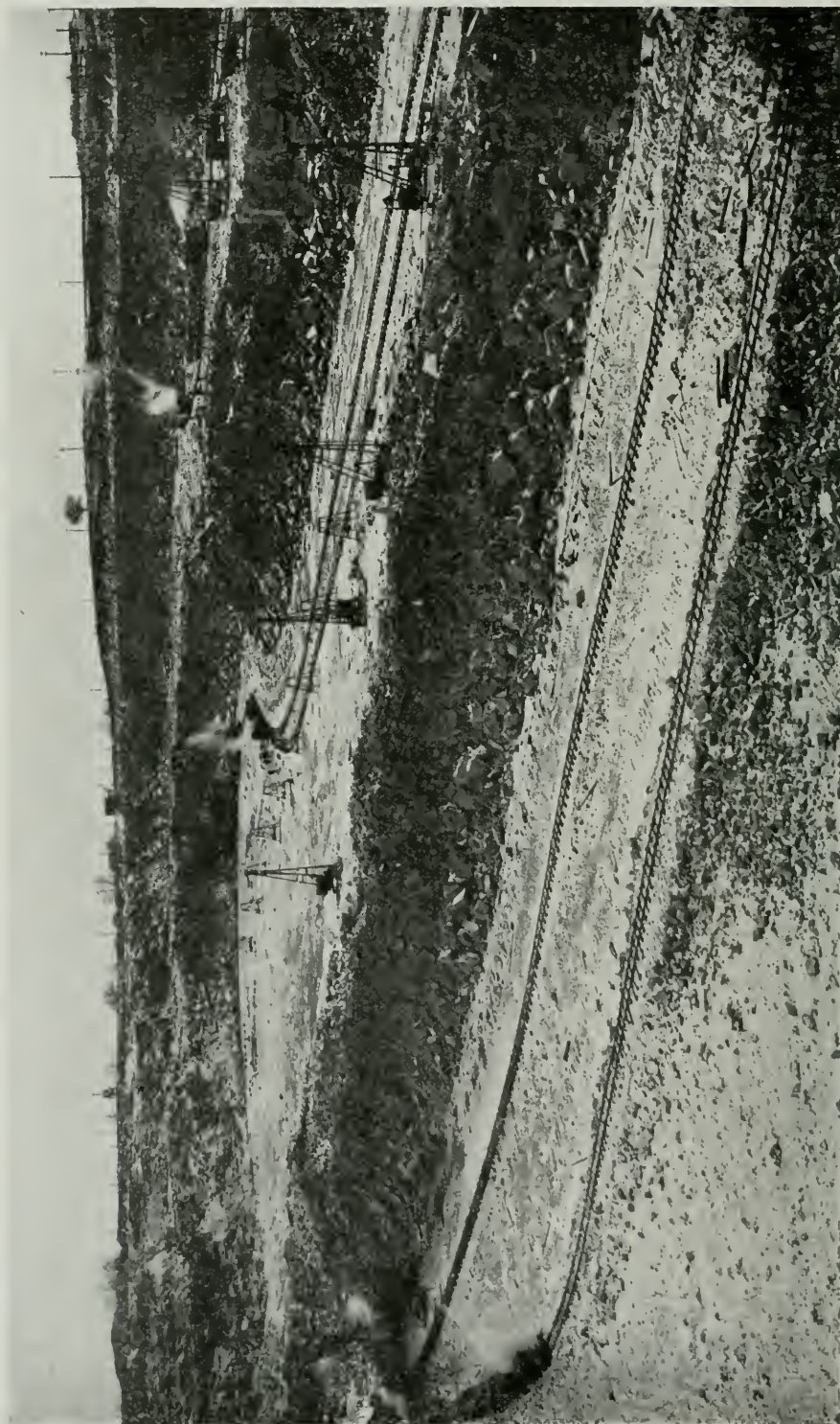
When inspection was made in July 21, 1920, a little stripping and blasting had been done and the machinery was being set up. The latter consists of: a McIntosh, Seymour and Company engine, a 110-h.p. Jenckes return tubular boiler, a Beatty and Sons three-drum contractor's hoist with vertical boiler, a Dominion Road Machine Company No. 5 Champion crusher with 14-inch by 26-inch jaw opening, and an Austin No. 4 gyratory crusher. The rock produced will be used for road making. Twelve men were employed.

H. B. MacConnell, Cayuga, Ont., is secretary-treasurer of the company and William Hicklin, Hagersville, Ont., is manager.

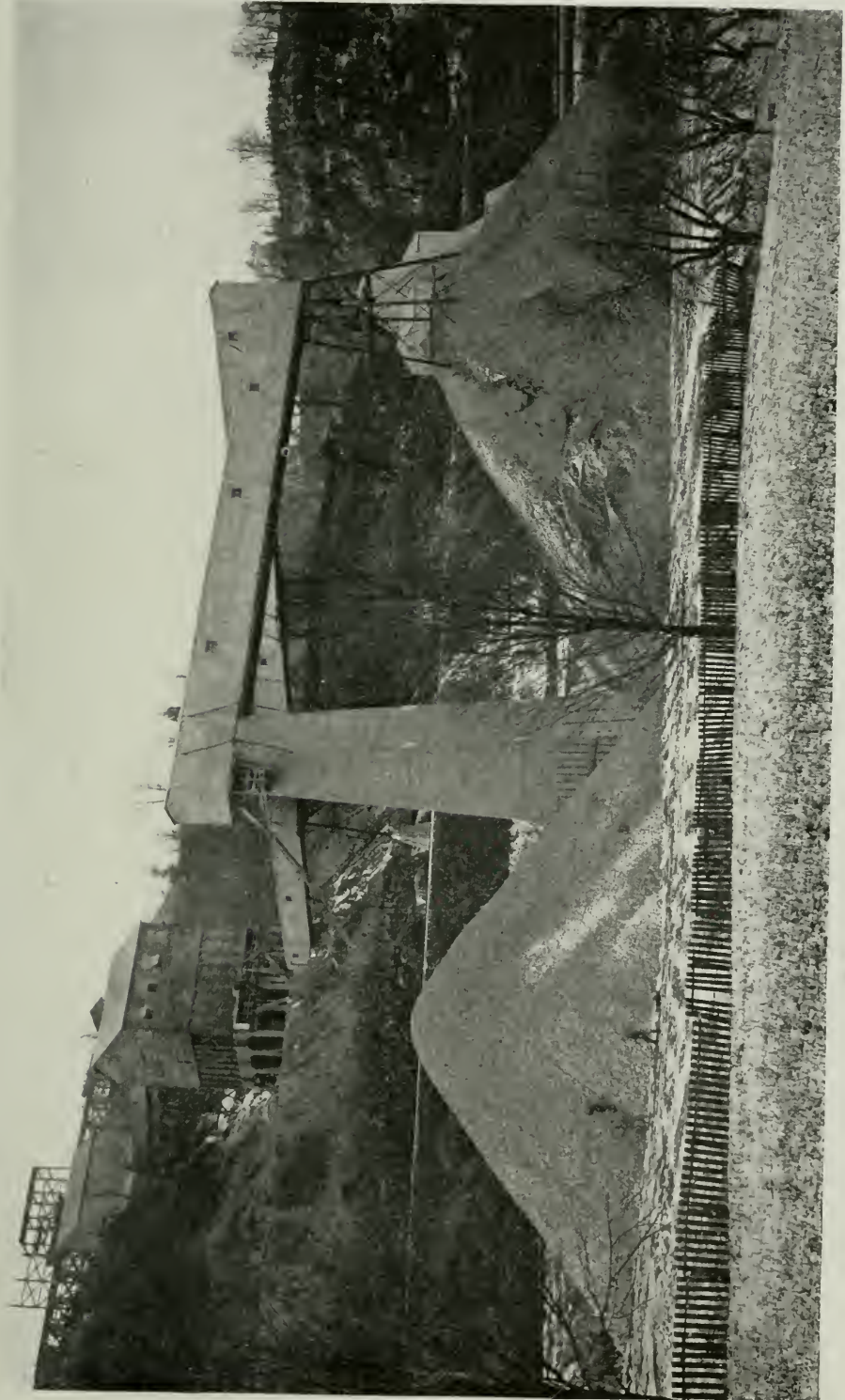
Crushed Stone, Limited.—The limestone quarry of this company near Kirkfield in Victoria county was operated continuously in 1920 from May 5th to the end of the year.

80,000 tons of crushed rock were shipped or stock piled. Shipments from the plants were seriously curtailed by a shortage of cars. Early in 1921, two Fuller mills were installed to take the place of Emery mills for the grinding of limestone grit. The dust (80 per cent through 200 mesh screen) from these mills is bagged and shipped for use in asphalt paving. The capacity of the mills will be 50 tons a day.

William T. McRae, Kirkfield, is superintendent and had 30 men employed.



Dundas quarry of the Canada Crushed Stone Corporation, Ltd., where 6 locomotives, 3 steam shovels and 12 well drills are operated.



Stock pile (100,000 tons storage capacity) of Canadian Crushed Stone Corporation, Ltd., at Dundas, Ont.

Christie, Henderson and Company.—The limestone quarry at Christie, on the Canadian Pacific railway west of Milton, was operated during the year 1920. The plant consists of three kilns, only one of which, however, was worked during the winter months. The quarry has a face of 70 feet and is drilled by a cyclone well drill. It produced 265 cars of lump lime.

The officers are: D. D. Christie, president; W. P. Gamble, manager; W. Priest, superintendent.

Coldwater.—The limestone quarry near Coldwater, Ont., was worked during nearly all of 1920 by the owners, George Higginson and Son of Coldwater. The excavation at this quarry now covers nearly two acres. A face of about 24 feet is being carried. The quarry property is in lots 19 and 20, concession XII, Medonte township.

John S. Cook and Son.—John S. Cook and Son, Wiarton, Ont., operate two dolomitic limestone quarries near that village in lots 7 and 8, concession XXIV, township of Amabel. These are remarkably good quarries. The beds are uniform and a large proportion of flag stones, sills, coursing stone, etc., is produced.

Elora.—The quarry, kilns and hydrating plant of the Elora White Lime Company, Limited, were operated until May 23, 1920, when the hydrating plant was destroyed by fire. The property of the company was then taken over by the Alabastine Company of Paris, and an up-to-date hydrating plant with storehouses was erected, and operations continued to the end of 1920.

The quarry from which the limestone is obtained is on the south bank of the Grand river, half a mile west of the town of Elora, and has a face of 28 feet. The limestone is high in magnesia containing 45.81% magnesian carbonate and 52.58% calcium carbonate. Drilling is done by cyclone drill and jack hammers. The stone is hauled in three-ton cars from the quarry up an incline to the top of the kilns.

There are five steel Arnould (steam burner) kilns, coal fired with firing floors 14 feet wide and 75 feet long.

The hydrating plant adjoins the kilns, and includes a lime floor in a one-story building, 45 feet by 75 feet; a three-story main building, 30 feet by 75 feet and a two-story storehouse, 28 feet by 130 feet. The buildings are all gypsum board lined and covered.

The lump lime drawn from the kilns is carried in buckets on a trolley to the lime floor, where it is dumped for cooling. When cooled, the cores are sorted from lime fit for hydration. The former, from which agricultural lime is made, is first crushed in an 8 x 10 Sawyer Massey jaw crusher, and then passed on a conveyor belt to a K-B pulverizer (hammer mill) and when reduced to three-eighths inch size is bagged or stored in bulk. The lime to be hydrated is passed directly from the lime floor to the K-B pulverizer by an 18-inch conveyor belt without preliminary crushing.

In this pulverizer, the lime is reduced to such a size that it will pass a three-eighths inch ring. It is then raised in a bucket elevator to a square bin of 60-ton capacity. From this bin the lime is fed to a 20-inch conveyor belt, to which is attached a poidometer or automatic device for weighing the correct amount of lime to be passed for hydration (slacking of the crushed lime by addition of proper amount of water) to a No. 2 Schaffer hydrator, capacity 10 tons per hour. Steam

generated in hydration is passed out through a stack over the machine and the cool dry hydrate is delivered from the hydrator to a Raymond mill (No. 0) by means of a screw conveyor.

The equipment of the Raymond mill includes the 8-exhaust fan, the pulverizer or beater which knocks the good hydrate free from impurities, the automatic throwout attachment in which the impurities not broken to powder are separated automatically from the grinding chamber, a six foot diameter double cone air separator in which separation of further oversize is made, and a six foot dust collector from which the finished material (99% through a 100 mesh sieve) is discharged to a 75-ton storage bin. The coarse or impure material separated in the mill is sent back to the agricultural lime bin.

From the 75-ton storage bin, the fine product is passed to a Bates automatic bagging machine. A special valve bag, which is self sealing when filled, is used.

The following is an analysis of the hydrated lime:

	Per. Cent.
Silica.....	0.48
Iron and Aluminum Oxide.....	.21
Calcium Carbonate.....	3.00
Calcium Oxide.....	45.74
Magnesium Oxide.....	34.36
Combined Water.....	16.00
	<hr/> 99.79

The capacity of the plant is 50 tons of hydrated lime and 20 tons of agricultural lime per day. The plant is almost entirely operated by electric power ("Hydro") 550 volts. Besides this equipment, there are two r.t. boilers, 25 and 15 h.p., to supply steam for the lime kilns and heating, and an 8-inch by 8-inch Fairbanks-Morse compressor, 108 cubic feet per minute capacity, for quarry drills and air.

Direct rail service is obtained by a spur from the C. P. R. (Cataract to Elora line) to the storehouse.

During the year 11 men were employed in the quarry and 33 at the kilns and hydrating plant. T. F. Robinson, Elora, Ont., was manager and Albert Brander oremen of the quarry.

ORANGEVILLE QUARRY

The quarry and hydrating plant belonging to the Contractor's Supply Company near Orangeville was operated for a short time in 1920 by the Alabastine Company of Paris, following the destruction of the hydrating plant at Elora.

Six men were employed in the quarry, and 15 men at the kilns and hydrating plant under Elmer Senn, R. R. No. 6, Orangeville, Ont.

Gallagher.—The quarry belonging to Gallagher Bros. is located on lot 15 in the sixth concession of Barton township. The drilling is done by steam. The quarry has a face of 25 feet. One kiln, with a capacity of 400 bushels per day, was in operation continuously during the year. Five men were employed.

Gibson.—The Gibson quarries near Beamsville in lots 13 and 14, concession VI, Clinton township, were at one time worked on a large scale for dimension and building stone by the Hon. Wm. Gibson of Beamsville; they now belong to Wm. Sutton of Port Dalhousie. Lincoln county took limestone in May and June from some of the waste dumps at these quarries.

Grenville Crushed Rock Company.—In 1920 this company started a new quarry and erected a crushing plant near Deek's siding, mileage 114, on the Canadian Pacific railway, Montreal to Smiths Falls line. The plant operated for three months in 1920, crushing 80,000 tons, part of which was shipped for ballast, the remainder being stock-piled.

The quarry and plant are in east half, lot 9, concession IV, (Gaw farm) lot 8, concession IV (Hanlan farm), and the south half of lot 8, concession III (Kelsey farm), township of Oxford, Grenville county.

The quarry equipment consists of two well drills driven by 10-h.p. motors (220 volts), a submarine piston drill, steam operated, a Marion Osgood Model 73 steam shovel, a 70-c Bucyrus steam shovel, 25 side-dump cars, capacity 6 cubic yards, a 60-ton Davenport locomotive, and three 26-ton Porter locomotives.

The quarry will eventually be operated on one bench with a 35-foot face. Stone is hauled from the quarry in side-dump cars (standard gauge tracks) to the foot of an incline, up which the cars are hauled by a single-drum reversible Beatty hoist, and then dumped by air into crusher.

The crushing equipment includes a No. 27 Kennedy gyratory crusher, and three No. 37 Kennedy gearless gyratory crushers, two No. 84 Kennedy revolving screens, 28 feet long, two 36-inch by 12-inch bucket elevators, two 24-inch belt conveyors, and bins, capacity 200 tons. The crushed stone ranges in sizes from $2\frac{1}{2}$ -inch to $\frac{1}{4}$ -inch, and is loaded directly from the bins into railway cars for shipment, or is sent to stock pile where one Jordan spreader is used.

The greater part of the plant is at present operated by steam, furnished by three 200-h.p. Polson marine boilers, and one 40-h.p. locomotive boiler for water supply. For driving the crushing plant, a 350-h.p. Wheelock cross-compound condensing engine is used. A Rand air compressor, class B2, is also installed, 12 by 12 by 19 by 18, steam duplex, capacity 708 cubic feet per minute.

A 100-h.p. Wheelock steam engine, 15 inches by 34 inches is used to drive a Westinghouse generator, 75-k.v.a., 3 phase, 60 cycle, 2,200 volts, 900 r.p.m.

During 1920, 100 men were employed in the quarry and on construction. When inspection was made in March, 1921, 50 men were employed under J. B. Bains, Oxford Mills, Ont., as superintendent.

The officers of the company are: president, H. F. McLean; vice-president, George S. Deeks; secretary-treasurer, Colonel C.W.P. Ramsay. The head office of the company is at Smiths Falls, Ontario.

Grimsby.—The county started a new quarry in June, 1920, on the top of the escarpment overlooking the village of Grimsby. This quarry is in lot 9, concession III, Grimsby township. The limestone is broken from the upper part of the cliff and falls upon a ledge from which it is hoisted to the top. The machinery used consists of two small boilers—a vertical and a traction, a contractor's double-drum hoisting engine, a Sawyer-Massey $9\frac{1}{2}$ -inch by 20-inch crusher, a bucket elevator and a traction engine. John Lawson of Grimsby was foreman.

Hagersville.—The stone quarry at Hagersville was operated during the greater part of the year 1920 by the Hagersville Contracting Company. The quarry is worked by two electric cyclone-drills and a $2\frac{1}{2}$ -yard steam shovel. The material is hauled in cars to the incline and taken up to the crushers, where it is crushed and screened to 4-inch, 2-inch, 1-inch, $\frac{1}{2}$ -inch and screening sizes.

The production for the year 1920 was 63,701 tons, which was used in building and road-making. An average of 28 men was employed.

The officers of the company are: president, C. M. Doolittle; superintendent, J. Stevens, secretary-treasurer, W. H. Lindsay, Hagersville.

Haldimand County.—In 1920 the county of Haldimand worked two limestone quarries for road metal, one at Nelles Corners and the other near Dunnville. Both were in charge of the county road superintendent, David W. McBurney, Hagersville, Ont.

The first-mentioned quarry is in lot 49, concession I south, in the township of Cayuga North and is about half a mile east of Nelles Corners. The county opened this quarry five or six miles ago and has since worked it intermittently. The equipment includes a gasoline-g geared hoisting engine, a Sawyer-Massey traction boiler, a derrick, a Sawyer-Massey 8-inch by 16-inch crusher, a trommel and an ore-bin. Fourteen men were employed during the summer under foreman Albert Best.

The Dunnville quarry which is worked by the county is in lot 5, concession I, north side of the Port Dover road, Dunn township. It has been worked for some seven years and is twelve feet deep. The equipment includes a Waterous contractor's hoisting engine and vertical boiler, derrick, Case crusher, trommel, bucket elevator and Sawyer-Massey gasoline tractor. Thirteen men were employed under foreman Albert Schurr.

Hambleton.—The quarry at Hagersville was operated for eight months during the year.

The quarry has a face of about 26 feet, and is worked by a cyclone drill and a No. 75 Marion shovel with a 4-yard dipper; an average of 14 men is employed.

Robert Hambleton, Hagersville, is president and manager.

E. Harvey and Son.—E. Harvey and Son operated one kiln during the year and produced 3,350 tons of lime, which was supplied to the building trade. The face of the pit is from 25 to 40 feet in height, and an average of 10 men was employed.

T. Hanna is manager.

Kingston.—In 1920 Roddy and Monk, 24 Elm street, Kingston, Ont., worked three limestone quarries in the city.

The "Division Street" quarry was worked for dimension stone with a force of three men. This quarry is equipped with two derricks, in connection with which hand winches are used.

The second quarry is on the west side of Montreal street and is worked for road metal only. In this quarry are two crushing plants driven by electric power and each consisting of two crushers, a rotary screen, and two bucket elevators. A traction boiler supplies steam for drilling. Twenty men were employed in this quarry. Directly across the road is another quarry which is owned by the city of Kingston and was worked by Roddy and Monk for crushed rock until December 1919.

The third quarry is on Patrick street and is worked for building and dimension stone. Three men were employed.

Lincoln County.—The county of Lincoln obtained limestone for road building from the three quarries mentioned below. The work was under the supervision of Peter Robertson, county road superintendent, Beamsville, Ont.

Marshall.—The quarry and lime kiln on lot 14, concession VII, township of Barton, of which John Marshall is owner and manager, were in operation for the greater part of the year.

The quarry has a face of from 12 to 20 feet; the rock is hauled by carts to the kiln where natural gas is used as fuel. The production for the year amounted to 28,000 bushels of white lime. Five men were employed.

Oliver-Rogers Stone Company, Limited.—This company operates a large limestone quarry in the eastern part of the city of Owen Sound on Ninth Avenue. Most of the rock is crushed, but building stone is also sold. The quarry is 20 feet deep. Samuel Oliver, 841 Fourth Avenue, Owen Sound, is manager.

The equipment includes the following machinery: one Listowel churn drill, one thresher engine to supply steam for piston drills, one 65-ton Bucyrus steam shovel, two Foden steam wagons, three guyed derricks, and four hoisting engines. In the crushing plant are: one No. 6 Austin gyratory crusher driven by a 100-h.p. motor, one No. 4 McCully gyratory crusher driven by a 30-h.p. motor, two rotary screens and the necessary bucket elevators.

Ottawa Suburban Road Commission.—The commission had two quarries in operation near the city of Ottawa during the winter of 1919-1920, to obtain limestone for road building, namely the McLaurin and Acres.

The work was in charge of Alan K. Hay, engineer to the Commission and W. J. Anderson, master mechanic.

The officers of the Ottawa Suburban Roads Commission are: chairman, John Bingham, Ottawa; Wm. Y. Denison and Warren Y. Soper, representing city of Ottawa; F. A. Heney and B. Rothwell, representing county of Carleton; Alan K. Hay, secretary and engineer. The office of the commission is in the Thistle Building, Wellington St., Ottawa. Ont.

McLaurin

The McLaurin quarry is located on lot 3, concession III, Gloucester township. When inspected in January, 1921, a 20-foot face of limestone was being worked. The opening extended 150 feet in length.

The plant consisted of a 30-h.p. Case portable boiler and engine, a 10 x 20 road crusher, bucket elevator, 16 foot screens in four sections and storage bins. Crusher platform was on level with quarry floor and stone was hauled direct to the crusher.

14 men were employed in the quarry and crushing plant under foreman Moses Denis.

Acres

When inspected in February, 1921, the Acres quarry, formerly called Graham's quarry was being re-opened by the Ottawa Suburban Road Commission.

The quarry is located at H. Acres' farm on lot 16, concession II, Ottawa front, township of Nepean, to the east of the Richmond road.

20 men were employed in charge of foreman Elijah Dawson.

The face of the quarry is ten feet. Drilling here is done by steam supplied by a 12-h.p. vertical boiler. Power for crushing plant is supplied by a 17-h.p. tractor engine. The crushing plant consists of a 10 x 20 crusher, road type, bucket elevator, screens in four sections and bins. Stone is hauled direct from the quarry floor to the crusher platform.

Pembroke.—Wm. Markus, Limited, has been for some years working a limestone quarry southeast of the town of Pembroke in lot 12, concession I, township of Pembroke. This quarry was at one time owned by Peter White. It is worked principally for crushed rock, but building stone is also produced. The greatest depth to which it has yet been worked is 15 feet.

The crushing and screening plant consists of: an 8-inch by 16-inch Sawyer-Massey crusher, a bucket elevator, a Sawyer-Massey trommel and a 20-h.p. Fairbanks Morse motor.

William Markus, Pembroke, Ont., is manager.

Prescott and Russell Counties.—The counties of Prescott and Russell obtained limestone for road building from the two quarries mentioned below. The work was under the supervision of F. A. Senecal, county road superintendent, Plantagenet, Ont.

Bourdon

The Bourdon quarry is situated a mile west of the village of Plantagenet Springs station on the C. P. R., short line Montreal to Ottawa. This was formerly known as the Winning quarry, worked for building stone but is now the property of E. Bourdon whose farm is in lot 6, concession II, township of North Plantagenet.

An 18-foot face of limestone was worked. Work began early in November, 1920, and was carried in till April, 1921.

17 men were employed under foreman Jos. Boileau of Plantagenet Springs.

Francoeur

The Francoeur quarry is a half mile from the village of Casselman (G.T.R., Ottawa to Montreal), on the east bank of the South Nation River, and is on the farm of G. L. Francoeur, concession VI, township of Cambridge, Russell county.

A 12-foot face of limestone was worked.

The quarry was worked for the first three months of 1921. Eighteen men were employed under foreman F. Gratton, Casselman, Ont.

Queenston.—The limestone quarry of the Queenston Quarry Company, Limited, near the village of St. David in Niagara township, was in operation throughout the year.

A layer of about 17 feet of gray stone is taken out for crushing; beneath this a face of 15 feet is quarried for building stone.

The plant consists of a No. 5 Austin gyratory crusher, a Simons disc crusher, and screens. The rock is crushed and screened to sizes 3-inch, 2-inch, 1-inch, and $\frac{1}{2}$ -inch, and used for road-building, and a small amount for flux.

During the year a new conveyor plant was built which carries the rock by two 20-inch belts, 160 feet and 80 feet in length, to the Michigan Central railway cars, or to stock piles.

The dimension blocks, bases and cut stone are shaped in the mill by two gang saws and one diamond saw. An average of 40 men was employed.

Charles Lowrey is president; R. J. Lowrey, manager; T. W. McKeown, secretary.

Renfrew.—Jamieson Lime Company, Renfrew, Ont., owns and operates two lime kilns, a brick-yard and several crystalline limestone quarries in and near the town.

One quarry is in Renfrew north of the Roman Catholic church. There are two kilns close to the quarry and all the rock quarried is burned to lime.

Nine men were employed under foreman Frank Cabulski.

A second quarry has been recently opened by the company on lot 5, concession II, Horton township. This is east of Renfrew and is on the J. B. McLaren or Froid, farm and on the Du Valiquette farm. In the fall a reinforced concrete lime-kiln was being built.

A third quarry, on the east side of town and locally known as the "third line" quarry, was being worked on a small scale in October. The stone here is, like that in the above-mentioned quarries, crystalline limestone, and an old pit near the present working is said to have been worked by Archie Anderson of Renfrew some twenty years ago for the production of monument stone. Five men were hand-drilling under foreman Michael Switch when inspection was made on October 13.

The company also owns a fourth quarry. This is north of Renfrew on the Jamieson homestead on the east half of lot 14, concession III, township of Horton, but it was not worked in 1920.

Alex. Jamieson, Renfrew, Ont., is manager of the company.

D. Robertson and Company, Limited.—The limestone quarry at Milton Heights was operated throughout the year 1920. The limestone quarry has a face of 70 feet. The quarry for building stone was worked part of the time only. The company produced about 7,100 tons of lump lime, and 60 cars of building and dressed stone.

D. Robertson, Milton, is owner and manager.

Smithville.—In 1919 the county of Lincoln opened a quarry south of and near Smithville in the south half of lot 6, concession IX, Grimsby township. The Dunnville branch of the T. H. and B. railway is beside the quarry. When inspection was made in July, 1920, a 17-foot face of limestone was being worked and the greatest depth reached was 24 feet; the excavation then covered about half an acre. The plant consists of a small vertical boiler, a Sawyer-Massey traction boiler, a Beatty and Sons' contractor's hoist, a derrick, a 10 by 22-inch "Good Road" Goderich crusher, a bucket elevator and a 16-foot screen in four sections. Fifteen men were employed under foreman John A. Miller of Smithville.

Standard White Lime Co.—The Guelph quarry and hydrating plant were worked during the greater part of the year. The plant was reconstructed and new machinery installed to decrease the cost of operations. The hydrating plant has a capacity of 50 tons per day and during the year the production was 978 tons of lump lime and 2,239 tons of hydrated lime. Fifteen men were employed.

The quarry at St. Marys was worked all year and produced 24,013 tons of lump lime and employed 15 men.

The company also operated continuously during the year a lime plant and two quarries at Beachville. The larger quarry on the west side of the property has a face of about 46 feet. The rock is loaded directly into cars by derricks and shipped to the sugar refineries, American Cyanamid Company, and to the blast furnaces for fluxing. A small amount is also sold for the manufacture of fertilizer.

The material from the east quarry is used in making lime and two kilns, each with a capacity of 250 bushels per day, were kept supplied.

An average of 60 men was employed.

Wm. Culford is superintendent.

The officers are: president, E. D. Christie; vice-president and secretary-treasurer, John Kennedy; manager, W. P. Gamble.

St. Marys Cement, Limited.—The quarry at St. Marys was worked continuously throughout the year 1920. It has a face of 86 feet and is worked by two cyclone drills. The rock is loaded into cars by steam shovels and hauled to the incline by two gasoline engines. It is crushed by a Taylor jaw crusher with a capacity of 500 tons per hour, driven by a 200-h.p. motor. From the crusher the material passes through a Mammoth Williams Hammer mill and is conveyed by belt to the mill.

The clay is taken from a pit adjoining the quarry and is loaded into cars by a steam shovel and hauled to the plant by a gasoline engine.

About 150,000 tons of rock and 60,000 tons of clay were delivered to the plant and 22 men were employed.

George H. Gooderham is president and J. G. Lind manager.

Toronto Plaster Company, Limited.—The company operated its quarry, kilns and hydrating plant at Teeswater, Ont., continuously through 1920. During the year, three Crocker Wheeler motors of 50, 40, and 5 H. P. (550 volts) were installed to take the place of steam power. One 90 H. P. boiler is retained to supply steam for the coal fired lime kilns. The entire product of the plant, which has a capacity of 25 tons a day, is shipped as hydrated lime.

Twenty-eight men were employed during the year. D. E. Kennedy, Teeswater is manager and Enoch Erb, superintendent.

Walker Brothers.—The Limestone quarry owned by Walker Brothers, Thorold situated in Stamford township, (lots 31 and 32, Concession IX, was operated continuously during 1920, producing crushed stone for highway work and limestone for pulp mills. About three quarters of the output goes to the latter. A spur line from the Niagara Falls, St. Catharines and Toronto railway at Thorold runs to the quarry.

The machinery used consists of three boilers, one 18-h.p. and two 24-h.p., a contractor's double drum hoisting engine, 10-inch by 16-inch crusher bucket elevator and screens in four sections. The product for crushed stone ranges from three-inch to dust. Stone for pulp mills is sorted out in the quarry, the size being about eight inches. Drilling for deep holes is done by means of a well drill driven by a gasoline engine. Steam-driven jack hammers are used for short holes. When inspected in November, 1920 the quarry was being worked in a face varying from 28 to 34 feet. An average of 22 men was employed during 1920.

David Walker, Thorold, Ontario, was manager.

Uthhoff.—The large quarry owned by the Ontario Stone Corporation, Limited, and situated at Uthhoff station on the C.P.R. was worked during the summer by Andrew Peterson and associates under contract. A 20-foot face was worked.

At the more westerly crushing plant at this quarry a jaw crusher was replaced by a No. 6 McCully gyratory crusher; this is driven by a 50-h.p. motor.

Vinemount.—The Wentworth Quarry Company, Limited, worked its quarry on lot 4, concession V, Saltfleet township, with a force of from 15 to 20 men. The quarry is about a mile southeast of Vinemount station on the T. H. and B. railway. A 16-foot face is being carried in this pit. Fred W. Schwendiman, Vinemount, Ont., is manager and M. W. Schwendiman, foreman.

Wentworth Quarry.—The Wentworth Quarry Company, at Vinemount, operated from June 1 to the end of the year. The quarry has a face of 16 feet of limestone and the drilling is done by a well drill driven by a gasoline engine. The rock is loaded into cars by a Model 61 Marion steam shovel, and a new Model 28 revolving shovel has been purchased for stripping. The crusher plant of 500-ton capacity is run by a 115-h.p. engine supplied with power from a gas producer. The product is graded from rock sand to 2-inch and is supplied for concrete and road building. The company produced 48,500 tons during the year and employed 16 men.

The officers are: S. Schwendeman, president and manager, and James Thompson, secretary-treasurer, Vinemount.

Brick Plants

Bartonville Pressed Brick Company.—The Bartonville Pressed Brick Company operated from March 1 to November 15, 1920. The pit has a face of 25 feet of red shale and the plant a capacity of 20,000 bricks per day. Four men were employed.

J. T. Schelter is president and E. Eden, superintendent.

Boyd Pressed Brick Company.—The Boyd Brick Plant near Milton was operated from January to October 1920. The plant has a capacity of 20,000 bricks per day and produced about three million red pressed bricks during the year. The face of the pit is 20 feet. The material is loaded into carts and drawn to the plant.

The officers of the company were: Alex. Graham Boyd, president; Robert Boyd, manager and treasurer; Charles Fessler, secretary.

The plant has been purchased by the Interprovincial Brick Company and will be operated as the Altas Brick Company, Limited.

Canadian Pressed Brick Company.—The Canadian Pressed Brick Company, at Bartonville, worked from April 1 to December 15, 1920. The pit has a face of 40 feet and about 3,200,000 bricks were made during the year.

Messrs. Lewis and Swinger, barristers, Hamilton, are president and secretary-treasurer. D. New is manager.

Don Valley Brick Works.—The plant in the Don valley, Toronto, operated during most of the year with a capacity of 150,000 bricks per day. They produce buff and red pressed, wire-cut and stock brick, and a small amount of partition tile. The total face is about 200 feet and is worked as four separate pits. The highest layer consists of 25 feet of buff clay and the second layer has a face of 65 feet of Erie clay; the third layer is sand, only part of which is used in brick making; the lowest layer is Hudson shale and has a face of 65 feet.

J. N. Bowman is manager and William Burgess superintendent.

Frid Brothers.—The brick plant and sand and gravel pit belonging to Frid Brothers, at Macklin Street and Dundas Road, Hamilton, was worked from May 15 to October 15, 1920. The pit consists of a layer of clay about 3 feet deep underlying which is sand and gravel. The clay is used in making red and white common stock brick. The brick plant has a capacity of 16,000 bricks per day and during the year produced 1,930,000 bricks. The sand and gravel are loaded into carts by hand.

Arthur Frid is manager and employed seven men.

Hamilton Pressed Brick Company.—The brick plant at the head of Kensington Avenue, Hamilton, was operated from April 1 to December 15, 1920. The plant has ten kilns with a daily capacity of 22,000 bricks. The pit is of red shale and has a face of 70 feet.

Robert New is president and manager and J. Elderkin superintendent.

Hepworth Silica Pressed Brick Company, Limited.—The Hepworth Silica Pressed Brick Company, Limited, operated its plant at Hepworth, Ont., from May to September, 1920, producing 1,500,000 silica pressed (sand-lime) bricks.

Sand (54 to 58% Si O₂) is taken from pits near the brick works and carried to the plant in small cars.

The equipment of the brick plant consists of 2 return-tubular 75-h.p. Inglis boilers, a Corliss engine, 16 inches by 36 inches, one steam tight hydrating cylinder 80 feet by 6 feet, two steam tight hardening cylinders, 80 feet by 6 feet two upright "King Bee" Berg presses, capacity 20,000 each per day and one sand drier (Dutch oven type; belt driven and revolving).

Red, white and buff coloured bricks are produced. The capacity of the plant is 40,000 per day.

The officers of the company are: president, Jas. Douglas, Hepworth, Ont.; vice-president, M. Forhan, Owen Sound, Ont.; secretary-treasurer and manager, P. H. Forhan, Hepworth, Ont.; directors, J. E. Campbell, W. M. Breeze, Chatsworth, Ont., L. Block, Owen Sound, Ont., J. H. Messener, New Hamburg, Ont.-P. S. Patterson, Toronto, Ont.

Milton Pressed Brick Company.—The plant at Milton worked continuously throughout the year 1920. The pit has a face of 60 feet of red shale and is worked in benches. The clay is loaded into cars by two steam shovels with buckets of $\frac{3}{4}$ and $\frac{7}{8}$ -yards capacity. The plant has a capacity of 20,000 bricks per day and the different grades of pressed and wire cut brick are manufactured. Thirty men were employed.

The plant at Streetsville has a capacity of 40,000 bricks per day and manufactures wire cut red brick. The face of the pit is 43 feet of hard red shale. It is drilled to the full depth, blasted and loaded by a $\frac{1}{2}$ -yard shovel into cars which are hauled up an incline to the plant.

The officers are: president, J. D. McCannell; vice-president and manager, F. R. McCannell; secretary, A. W. Holmstead; general superintendent, C. E. Hill.

Port Credit Brick Company.—The brick plant at Port Credit worked from January, to August 1920. The pit has a face of 40 feet and is operated by one Marion Model 60 shovel with a 2-yard bucket. The product consists of wire cut and red pressed bricks.

M. J. Haney is president and J. F. M. Stewart manager.

Red Star Brick Company.—The brick plant of this company at Stratford was operated for about seven months during the year and manufactured 550,000 red clay bricks. The face is 3 feet and the clay is hauled to the plant in carts.

W. H. Barnhardt is manager.

Shale Brick Company of Canada, Limited.—The brick plant of Cooksville operated from the first of the year to December 1, 1920. The pit has a face of 9 feet of clay and 3 feet of shale beneath. A Marion steam shovel with a 3-yard bucket loads the material into cars which are drawn to the plant by a dinky engine. The plant has a capacity of about 150,000 bricks per day and a total of about twenty million was manufactured during the year. Eight men were employed in the pit.

A. N. Cote is manager.

Standard Brick Company, Limited.—The plant of the Standard Brick Company, Limited, on Greenwood Avenue, Toronto, produced about 5 million bricks during the year. The pit has a face of about 50 feet of blue clay and the plant a daily capacity of 28,000 bricks.

W. Hayes, 352 Greenwood Avenue, is manager.

Streetsville Brick Company, Limited.—The brick plant at Streetsville operated from March to August 31, 1920, and produced about two million bricks. The plant has a capacity of 20,000 red pressed brick per day and the pit has a face of 27 feet of red shale.

F. Longwell is manager and secretary-treasurer.

William Theaker.—The plant for the manufacture of cement blocks, on Kenilworth Avenue, Bartonville, was operated for nine months during 1920 and has a capacity of 100 cement blocks per hour. The gravel is taken from a pit on the property and sand is purchased from the Brantford Sand and Gravel Company.

William Theaker is owner and manager and employed seven men.

Toronto Brick Company, Limited.—The plant located at Swansea worked throughout the year 1920 manufacturing white sand and lime bricks. The sand is taken from the pit at the plant and the lime is received from the lime works at Coboconk. The pit has a face of 50 feet and the material is loaded into cars by a Thew steam shovel and hauled to the plant by an electric locomotive. The capacity of the plant is about 40,000 bricks per day.

J. D. Smith, Swansea, is superintendent.

The company has a plant at East Toronto which was operated during the greater part of the year and has a capacity of 48,000 bricks per day. The pit has a face of 20 feet. The material is loaded by an electric shovel with 1½-yard bucket into tram cars and hauled to the plant by an electric locomotive. Three men were employed.

J. K. Fordyce is superintendent.

A. H. Wagstaff.—The plant of A. H. Wagstaff was operated during the greater part of the year 1920, the production being about 6,000,000 red bricks.

The pit has a face of about 45 feet of blue clay and the plant a capacity of about 30,000 bricks per day.

A. H. Wagstaff is owner and manager.

York Sandstone Brick Company.—The brick plant at East Toronto worked from the beginning of the year to December, 1920. The sand pit has a face of 25 feet and the sand is carried a distance of 500 feet to the plant by a belt conveyor. The lime is obtained from the Canadian Lime Company at Coboconk. The plant has a capacity of 46,000 bricks per day, and had a total production of 10,690,000 bricks. Two men are employed at the pit.

T. J. Smith is manager and W. A. Smith, East Toronto, is secretary-treasurer.

Sand and Gravel

Armstrong Supply Company.—The Armstrong Supply Company operated a gravel pit and washing plant at Burlington Heights during 1920. The pit has a face of 60 feet and the material is loaded into cars by a 15-ton shovel. The cars are hauled by a gasoline locomotive to the foot of the incline and then hoisted to the plant, where the sand and gravel are washed and screened. The different grades are deposited in bins from which trucks are loaded. The total production during the year was 30,132 yards of gravel and nine men were employed.

The officers are: president, Charles Armstrong; manager, C. K. Armstrong; secretary-treasurer, Z. M. Armstrong, 326 Lister Building, Hamilton.

Barton Sand and Gravel Company.—The washing plant of the Barton Sand and Gravel Company, at Bartonville, was not operated during the year owing to failure to obtain water for the plant. Sand and gravel were drawn from the pit by teams for building purposes only.

Bennet.—Joseph Bennet's sand and gravel pit at Scarlet Road and East Drive, near Weston, was operated during 1920.

One bucket loader and one screen are driven by motors; the material is loaded into trucks. The face of the pit is 13 feet.

Joseph Bennet is manager and owner.

Benson and Patterson.—The sand and gravel pits at Stamford worked continuously during the year and shipped 21,000 yards of moulding sand and 10,000 yards of building sand.

The pit has a face of 60 feet with three layers of material: gravel, building sand and moulding sand. The layers of sand are such that the different grades can be obtained without screening.

The moulding and core sands are shipped in four grades; the building sand is shipped as required for brick, concrete, plaster, cement blocks, cement tile, and asphalt.

A pit was opened up during the year for moulding sand only.

Two shovels, each driven by a 40-h.p. electric motor, are used to load the material directly into cars.

F. S. Benson and Robert Patterson are owners and managers.

Constructing and Paving Company.—The sand and gravel pit near Erin was operated from May 1 to November 30, 1920. The pit has a face of 17 feet and material is loaded into cars by a steam shovel and hauled to the plant in dump cars. The rock passes through the crusher and is elevated to the screens and graded to two-inch stone, pea gravel, and sand, of which 157 cars were shipped during the year.

James Pearson is president and treasurer and A. A. Ridler superintendent.

Durham.—The John E. Russel Company of Toronto operated a gravel pit on the property of the National Portland Cement Company, Durham, for six months during 1920.

In the pit a Marion "A" 30-ton steam-shovel is used to dig the gravel, which is loaded into dump cars, and hoisted up an incline to the cement plant.

In arranging a crushing and washing plant, a part of the National Portland Cement Company's machinery has been used. The gravel is dumped into a No. 5 Gates crusher, (driven by a 50-h.p. motor, 550 volts) from which it is taken by a bucket elevator (10-h.p. motor, 550 volts) to a 40 inch Austin rotating screen (20-h.p. motor, 550 volts), which makes the following products: sand, $\frac{3}{4}$ inch, 1-inch and 2-inch sizes, which are passed to storage piles under which a belt conveyor (10-h.p. motor, 550 volts) passes in a tunnel so that the sized material can be conveyed to railway cars for shipment. The capacity of the plant was 400 tons a day.

Ten men were employed under Harvey W. Wilson, Durham, Ont., as superintendent. The head office of the company is at Harbour Building, Toronto, Ont.

Forbear Sand and Gravel.—The sand pit of the Forbear Sand and Gravel Company, at Maple, was worked throughout the year and produced about 60 cars per month. The face of the pit averages 35 feet in height and the sand is loaded into cars by a Whirley McNyler one-yard clam-shell bucket. The cars are hauled by a steam locomotive to a trestle and dumped into railway cars. Seven men were employed.

Thomas E. Forbear is owner and manager.

Hamilton Sand and Gravel Company.—The Hamilton Sand and Gravel Company, at Burlington Heights, operated throughout the year. The pit with a face of 40 feet and material is loaded by an electrically driven shovel with a 1-yard

bucket into cars and hauled up the incline to the crushing plant. The gravel is crushed, washed, screened to two grades of sand and three grades of gravel and loaded into trucks from bins. The plant has a capacity of 200 yards per day.

The officers are: president and secretary-treasurer, Wm. Kerr; E. S. Kerr, manager.

Maple Sand and Gravel.—The sand pit at Maple was worked for about eleven months in 1920. The face of the pit is 100 feet and the sand is loaded into cars by a 15-ton locomotive crane with a 1½-yard bucket and a stationary crane with a ½-yard bucket. Twelve thousand cars of screened sand, gravel and pit run were shipped. A small amount of 4-inch, 6-inch and culvert tile was also manufactured by the Maple Sand, Gravel and Brick Company, Limited.

Thomas Cousins is manager.

Rocsand—The sand and gravel pit of the Rocsand Company, Limited, at Erin, was operated from June 15 to November 15, 1920. The plant consists of one steam shovel with a 1½-yard bucket, two crushers and screens. The material is hauled up the incline by hoist to the grizzly and after passing through crushers and screens is elevated to bins or carried to the stock pile by a belt conveyor. The product is shipped in three grades, 1-inch, ¾-inch and sand.

H. N. Kittson, is president and W. S. Connolly vice-president and secretary-treasurer, Hamilton.

Smythe.—The sand and gravel pit at Scarlet Road and East Drive was leased and operated by C. Smythe from May 1 to the end of the year 1920. The pit has a face of 13 feet. The material is raised by a bucket elevator to the screen and bins, the trucks being loaded from the bins.

C. Smythe, 345 Runnymede Rd., Toronto, is manager.

L. Taylor.—Sand and gravel for building purposes were sold by L. Taylor, at Bartonville. The pit has a face of 12 feet and material is drawn by teams.

L. Taylor is owner.

Viney Pit.—The Windsor Sand and Gravel Company, Limited, operated its gravel pit along the Pere Marquette railway, 1½ miles west of Leamington, from April 1st to December 1st, 1920, producing 75,000 cubic yards of material. This pit has been in operation eight years and has a working face of 50 feet. Twelve men were employed under E. McKenzie, Leamington, Ontario, as superintendent.

The officers of the company are: president, A. Leslie, Kingsville, Ontario; vice-president, W. Willis, Walkerville, Ontario; secretary, Hugh McDowell, Windsor, Ontario.

VI.—Smelting and Refining Works

Blast Furnaces

Algoma Steel Corporaton.—The Algoma Steel Corporation is a subsidiary company of the Lake Superior Corporation. The officers are: president, W. C. Franz; vice-president, James Dawson; assistant general superintendent, Joseph W. Wilson; chief engineer, F. Smallwood; works engineer, C. H. Speer; superintendent blast furnaces, James H. Bell; superintendent open hearths, A. H. Hugill; superintendent bloom and rail mill, O. Davies; superintendent merchant mill, James Lycett; superintendent coke plant, Wm. Seymour; mechanical superin-

tendent, Carl Stenbol. David Kyle, the general manager, died in April, 1920, and was succeeded by J. D. Jones who has been general superintendent. Charles E. Duncan who began work with the Algoma Steel Corporation in 1909 and was general superintendent until 1915, returned to the corporation's service in April, 1920, in the same capacity; on February 26, 1921, Mr. Duncan died and his position has not yet been filled. The secretary of the corporation is Alex. Taylor, Traders Bank Building, Toronto; the secretary of the Mines Department is George S. Cowie, Sault Ste. Marie, Ont.

The four blast furnaces ran as follows in 1920: No. 1, all year; No. 2, until December 12, when it was banked; No. 3, until June 14 and again from July 3 to December 21, when it was banked; No. 4, from April 14 to December 23, when it was banked.

A new double-strand Uhling casting machine was put in commission in March; it has effected a considerable saving in labour.

At the end of the year the force in the blast furnace department consisted of but 90 men. James H. Bell is blast furnace superintendent; James Dale assistant blast furnace superintendent; and Harry Hitchens blast furnace master mechanic.

Canadian Furnace Company, Limited.—The furnace at Port Colborne was in operation throughout the year 1920 except for a period of six weeks when the furnace was being relined.

The product was 92,375 tons of malleable and wrought iron from ores impired from the Lake Superior region.

During the year the new first aid building was completely equipped.

An average of 160 men was employed.

The officers of the company are: Frank B. Baird, president; B. Marron, manager; F. E. Deschenes, superintendent; G. J. Higgin, mechanical superintendent.

Steel Company of Canada.—During the year 1920 "B" furnace was operated continuously and "A" was closed down for seven months owing to the shortage of coal, during which time the furnace was relined.

The new pig casting machine was put into operation during the year. The metal is drawn from the furnace into ladles and hauled to the plant by locomotives and poured into moulds on an inclined elevator. The moulds are cooled by water spray while leaving the elevated and then dumped on a conveyor which carries them to the cars or stock piles.

The total production of the foundry, malleable and basic iron for the year was 166,000 tons with an average force of 160 men.

The officers are: Robert T. Hobson, president; R. G. Wells, works manager H. H. Champ, secretary-treasurer; H. G. Hilton, blast furnace superintendent, all of Hamilton.

Refineries

Coniagas Reduction.—The Coniagas Reduction Company, Limited, operated its refinery at Thorold during the year on ores from the mines at Cobalt. The products were: silver, white arsenic, metallic cobalt, metallic nickel, cobalt oxide and copper sulphate. The production of silver for the year was 994,190 ounces and of copper sulphate 221,920 pounds. An average of 100 men was employed.

The officers of the company are: R. W. Leonard, president; J. J. Mackan, secretary-treasurer; D. A. Mutch, superintendent.

Deloro Smelter.—The Deloro Smelting and Refining Company, Limited, operated throughout 1920, treating about 550 tons of ore, concentrates and residues per month at its plant at Deloro, Hastings county. From 250 to 275 men were employed.

The plant now includes departments for the production of: silver and arsenic, cobalt and nickel oxide; alloys: stellite and festel metal, cobalt and nickel; insecticides: paris green, arsenate of lead and arsenate of lime; cutlery: festel and stellite metal, forged and finished for table knives; cobalt salts,—this department was added during 1920, and now turns out cobalt carbonate, sulphate and acetate.

The officers are: president, M. J. O'Brien, Renfrew, Ont.; vice-president, J. Ambrose O'Brien, Ottawa; managing director, Thos. Southworth, Ottawa; general manager, S. B. Wright, Deloro, Ont.; consulting metallurgist, S. F. Kirkpatrick, Ottawa; general superintendent, R. A. Elliott, Deloro; secretary-treasurer, F. A. Bapty, Deloro.



Insecticide plant, Deloro Smelting and Refining Co.—The buildings from left to right are, hydro-electric sub-station, process building, packing and storage building.

International Nickel Company of Canada.—At the Port Colborne refinery of this company operations were carried on throughout the year, but on a reduced scale. For part of the year the total output of matte from the Copper Cliff furnaces was shipped to this plant. There were not any important changes in equipment or practice during the year.

John Moore is general manager and J. T. Kemp, assistant manager. An average of 453 men were employed during the year.

Ontario Smelters and Refiners, Limited.—This company, formerly the Standard Smelters and Refiners, Limited, Chippawa, Ontario, took over the plant of the Metals Chemical Company, Limited, at Welland on April 12, 1920.

After remodelling the plant the new company commenced operations early in July and worked continuously to the end of the year, producing nickel sulphate, cobalt hydrate, cobalt oxide and nickel oxide, all of which were obtained from retreating residues.

Thirty-five men were employed.

The officers of the company are: president, Chas. E. Potter, 1505 Royal Bank Building, Toronto; vice-president, A. Herbold, Chippawa; secretary-treasurer, P. W. Dunbar, Toronto; directors, H. Edward, Montreal; Melvin Jenkins, Buffalo, N.Y.; general manager, J. F. Hickling, Welland.

INSTRUCTION CLASSES FOR PROSPECTORS

By W. L. Goodwin

Introduction

Having been instructed by the Minister of Mines to organize classes for prospectors in selected centres in Ontario, the writer began on November 22nd, 1920, to make the necessary preparations, including collection and breaking up of minerals and rocks for specimens. In the basement of the Parliament Buildings were found materials which supplied about fifteen mineral species. About twenty were obtained from Queen's University through the courtesy of Professors G. J. McKay and E. L. Bruce. A few species were collected in the field and the remainder, making a set of 48 minerals and four rocks, were bought from Ward's Natural Science Establishment, Rochester, N.Y. The work of breaking up this material was so far advanced early in December that it was found possible to begin at Madoc on December 7th. After closing the class there, on December 21st, the preparation of the outfit was continued and completed by January 8th.

Methods Adopted

Classes were held in twelve places:—Madoc, Sault Ste. Marie, Port Arthur, Fort William, Sudbury, Haileybury, Swastika, Kirkland Lake, South Porcupine, Timmins, Elk Lake, and North Bay, covering the time from December 7th, 1920 to June 2nd, 1921. In each place the work consisted of two parts: a class for the determination of minerals by field tests, and a course of eight lectures on the Elements of Geology. The study of minerals was necessarily confined to daylight hours, but the lectures on geology were given in the evening. For the study of minerals, the material was distributed in small pieces to each member of the class. After determination, the occurrence, value, uses, etc., were discussed, and then printed descriptive labels were distributed, in which the specimen could be wrapped and kept for future reference. In this way it was found possible to study forty-eight minerals and several rocks, in the ten days allotted to each place. In addition to some four or five typical rocks, which were used in all the places, I found it possible, particularly in the northern gold fields, to do useful work with the rocks peculiar to the neighbourhood. The day class in each place had nine or ten sessions of about an hour and a half each.

The evening lectures were developed into a logical course on the Elements of Geology, illustrated by lantern slides, the object being to lay the foundation for more systematic study and the better understanding of reports as they are issued by the Geological Survey of Canada and the Ontario Department of Mines. These are quite generally studied by prospectors and there were frequent expressions of the helpfulness of the lectures in this connection. Eight lectures were given in each place, with the exception of North Bay, where it was thought advisable to shorten the time for both classes. It is to be noted that the evening lectures were attended by many who were not free to leave their work during the day, and by others who had a purely intellectual interest in the subject. It was felt that something was being done in this way to stimulate a more general and intelligent interest in mineral industries. To this end the lectures were always used, when possible, as a means of conveying information about the ore deposits of Ontario.

Attendance at Classes

The minerals classes were attended not only by prospectors, but by others interested in mineral industries. Some of these will become prospectors. In order to enlarge the horizon of the prospectors, a good deal of attention was paid to minerals that are not being particularly looked for. For example, samples of tin-stone were distributed everywhere, and, as soon as the material could be obtained, tin-stone in the peculiar granite in which it is usually found was shown, and large specimens left in each locality, either in the Mining Recorder's office, or in some other place agreed upon.

A good deal of work was done in the identification of minerals brought in by members of the classes. For this purpose a blowpipe set was added to the outfit. The meetings of the classes were always prolonged by work of this kind, and by consultation with the prospectors and others looking for information and advice. Where the numbers were large this made a long and busy day.

In the following tabular statement "Registration" refers to the total number attending the class for the study of minerals. Under "Average Attendance" are given numbers obtained by actual count in the case of the minerals class, and by as close an estimate as possible for the evening lectures on geology. In each place there were prospectors and others who were unable to attend the day class. Others were in the field, but had friends or partners attending the class. For such cases sets of the samples were made up when asked for. A record was kept and the numbers are given in the column "Extra Sets of Minerals." The sets of those who attended only part time were also made complete. In this way seven hundred and twenty-four complete sets of fifty-five specimens each were distributed.

Place	Date	Registration	Average Attendance		
			Minerals	Geology	Extra sets of Minerals
Madoc.....	Dec. 7—21.....	60	36	29	5
Sault Ste. Marie.....	Jan. 11—22.....	110	81	81	20
Port Arthur.....	Jan. 25—Feb. 4..	30	23	34	15
Fort William.....	Feb. 7—17.....	38	22	60	20
Sudbury.....	Feb. 23—Mar. 5..	21	14	49	15
Haileybury.....	Mar. 8—18.....	47	32	76	20
Swastika.....	Mar. 21—31.....	26	16	70	13
Kirkland Lake.....	Apr. 4—14.....	28	18	89	25
South Porcupine.....	Apr. 18—28.....	44	24	56	25
Timmins.....	Apr. 30—May 11..	60	35	74	20
Elk Lake.....	May 14—25.....	30	15	73	16
North Bay.....	May 27—June 2..	15	6	17	21
Totals.....		509	332	708	215

The low average attendance at the day class is to be explained by the fact that many of the prospectors did not join the class until a day or two after it was started. In some cases, too, members of the class had to break off before the end, owing to change of shift, having assessment work to do, and other causes. In some cases the news did not reach them until the class was well along. In nearly all places the class grew almost to the end. The local newspapers gave effective help by editorial notices and reports of progress as the classes went on.

Madoc

By arrangement with Reeve Burns the classes were held in the village hall. In addition to the local prospectors the classes were attended by several who came from considerable distances—one from Bancroft. By request an extra class was carried on for the Model School teachers and older students. While this extension of the work was not sought, it was not refused in any place where asked for. It will increase the interest in the study of minerals, and may help to keep up the supply of prospectors. Mr. Geo. H. Gillespie, and Mr. A. H. Watson of the *North Hastings Review*, were of great assistance in organizing the class. I wish also to thank Rev. T. H. H. Hall, and Messrs. Chris. Henderson, Donald Henderson, Wm. Cross, C. W. Wallbridge, George Lee, and Karl Stokloser for assistance in collecting minerals. The locality is particularly rich in minerals, and there are a number of keen prospectors at work there. Pyrolusite and bog manganese were brought in by members of the class and identified. Manganese ores in economic quantities are a possibility there. Through the kindness of Mr. Geo. H. Gillespie of G. H. Gillespie & Co., a large supply of tale was obtained. Mr. Robert Bryden, Manager of Canadian Industrial Minerals, sent me a box of selected fluorspar.

Sault Ste. Marie

The minerals class was held in the Board of Trade rooms, and I wish to thank the Secretary, Mr. W. E. Wolfe, for his hearty co-operation and assistance in organizing the classes. Mr. W. N. Miller, Mining Recorder, and Principal Rudlen of the High School were also very helpful. Mr. T. Taylor was engaged as assistant and his services were a considerable factor in making the work go smoothly and satisfactorily. Owing to the unexpectedly large numbers, it was found necessary to divide the day class, one section meeting at 10 a.m., and another at 2 p.m. By request a small class of graduates and advanced students of the High School was formed and I met them at 3.45 p.m. Each class was carried on for about an hour and a half. The evening lectures were held in the Carnegie Library. The very large attendance in the classes for identification of minerals introduced rather serious difficulties both in finding time for the long day's work and in eking out the supply of mineral specimens. The interest in prospecting had been stimulated by the discovery of gold near Goudreau lake, and the temporary closing down of the Algoma Steel works set free a number of prospectors working there for a grubstake, as well as many others who had made up their minds to go in for prospecting. The prospectors consulted me about a field class for the summer, asking if I or some other person could be sent by the Department of Mines to instruct such a class. I suggested that they should organize, draw up a petition, and forward it to the Minister. Forty members of the class expressed their intention of joining such a class, if it were organized. On invitation of the Rotary Club I addressed the members on the relation of the prospector to mineral industries. The Carnegie Librarian, Miss Carlyle, consulted me about books suitable for consultation and study by prospectors. Later I sent her lists supplied by W. G. Miller, and W. M. Goodwin.

Port Arthur

The city council provided quarters for the minerals class in the Ruttan building, and for the evening lectures in the council chamber, Whelan building. I engaged Mr. H. Watts as assistant. Mayor Matthews, Col. S. W. Ray, Col. Francis, J. W. Morgan (Mining Recorder), B. M. Wylie (Crown Timber Agent), and J. E.

Marks gave aid and counsel in carrying on the class. I have to thank Mr. Marks for the loan of a valuable series of photographs taken in the interior of the Labrador country. Slides were made from these and used as effective illustrations in the geology lectures. Mr. F. Rodda, engineer of the Atikokan Iron Company, brought in a quantity of magnetite for use in the mineral classes, and F. Hille gave me samples of siderite and other iron ores for identification. A number of the prospectors brought in samples of molybdenite for identification. Mrs. A. S. Wink, Public Librarian of Port Arthur, wrote asking for a list of books suitable for prospectors. I sent her a list selected from those supplied by Dr. Miller and Capt. Goodwin. At the close of the classes prospectors and other citizens entertained me at lunch and invited me to speak on prospecting in relation to our mineral industries.

Fort William

Here the Board of Education provided a room for the minerals class in the Collegiate Institute and a lecture room in the fine new Technical School building adjoining. Principal E. E. Wood welcomed the classes very cordially and did much to make our work there pleasant and profitable. Mr. R. Cockburn acted as assistant. A number of keen and experienced prospectors make their headquarters in Fort William and Port Arthur. Some of those attending the classes were well acquainted with minerals. Both in Port Arthur and Fort William there is much interest in the development of an Ontario iron and steel industry using Ontario ores. Something might be done with the Atikokan and Mattawin ranges by uniting various interests and operating on a large scale. The Kiwanis Club invited me to an evening meeting to address them on our mineral industries. In connection with our iron ore resources, I ventured the opinion that we should develop processes and practice suitable to our own ores, rather than attempt to make our ores fit the established practice. Through the kindness of Dr. Oliver, Public Health Officer, I made an inspection of the Public Library, a fine building, which is used not only as a library, but as a community centre. The Librarian, Miss Black, showed me a large number of books suitable for prospectors. Very few additions are required to make a good consulting library for their purposes.

Sudbury

On the way to Port Arthur, I stopped off at Sudbury and in company with Mr. R. H. Hutchison, Principal of the Mining School there, made an examination of the possible places of meeting for the classes. It was decided that the most suitable places were those offered by the Board of Education, that is, for the day class, a room in the Mining and Technical School building, under construction, and for the evening lectures the assembly room of the High School. It was expected that the new building would be far enough advanced for this arrangement, but as the date for beginning in Sudbury was two weeks earlier than planned, I found that the room was in an unfinished state. However, the architect and contractor saw that it was made comfortable for us, and it turned out well. The building is particularly well lighted with windows, a good feature where minerals are to be examined. A number of prospectors living at Shining Tree did not see the change of date and so missed attending the class. Others had made arrangements which prevented them from coming at the earlier date. I engaged Jas. Cryderman as assistant. Some members of the class came from Copper Cliff, Shining Tree and Coniston. By request I attended a meeting of the Sudbury Branch of the Canadian Institute of Mining and Metallurgy and addressed them on the iron and steel industry. Much interest was taken in the classes by the staff of the High School.

and I wish particularly to thank Mr. R. H. Hutchison of the Mining School for his assistance in organizing the class, and Mr. C. A. Campbell, Mining Recorder, for his willing and efficient help.

Haileybury

On arrival in Haileybury I had the valued assistance of the Mining Recorder, Mr. N. J. McAulay, in making arrangements for the classes. In conference with Mr. W. H. Tuke, Principal of the High School, a laboratory in the High School building was selected as the meeting place for the day class, and the assembly room was allotted to us for the evening lectures. Both were found very convenient and comfortable. Thanks are due Principal Tuke, Mr. James Hill of the Mining Department of the school, and other members of the staff. Here, as in some other places, the prospectors were a little slow in gathering, but finally they fairly crowded the small laboratory, many coming from Cobalt and New Liskeard and one from as far away as St. Thomas. The great majority of the class were experienced prospectors with considerable knowledge of minerals and rocks. In conversation with some of them I found that they had been studying text books like those of LeConte and Kemp. Mr. L. E. Hamilton, a student of the Mining School, assisted in the work of the classes. At the close of the Haileybury classes, it was arranged by correspondence with the deputy Minister of Mines that Mr. Hamilton should act as assistant to the end of the campaign. This arrangement worked out well, and Mr. Hamilton was thoroughly satisfactory.

At the close of the classes a Prospectors' Association was organized with Mr. James Hill of the Mining School as President, Mr. Train as Secretary-Treasurer, and Dr. W. L. Goodwin as Honorary President. At a banquet held a day or two later at which about eighty prospectors and mining men were present, the organization of the Temiskaming Prospectors' Association was completed, and the whole subject of prospecting in relation to mineral industries was thoroughly discussed. This discussion was made more valuable by the presence of a number of mine managers who could give the point of view of the investor. It would doubtless encourage prospecting and lead to more rapid development if there were some better connecting link between the prospector and the investor. Too often the prospector finds himself unable to continue in his chosen calling because he has reached the end of his means and has been unable to make a sale of claims. It is quite likely that further development of some such claims would show valuable results. What seems to be needed is some more systematic provision for development. Some better plan than the present rather haphazard way might be worked out by frank discussion at joint meetings of prospectors' associations with the Mine Managers' Association and similar bodies.

Swastika

This place was chosen on the request of a Prospectors' Association which has its headquarters there. We were met at the station by Mr. H. Geo. Ginn, Mining Recorder, Mr. T. M. Boisvert, President, and Mr. C. Billington, Secretary of the Prospectors' Association. Prospectors and others gathered in the evening in a room over Boisvert's store and I addressed them there. It had been the intention to start the class that afternoon, but as the train was several hours late, that was found impossible. A good start was made next day, the day class over Boisvert's store, and the evening lectures in the Union Church. Thanks are due Mr. T. M. Boisvert for the use of his room, to Messrs. Billington, Boisvert and others for assistance in fitting up the room and moving the apparatus from the station, to the Board of Management of the Union Church for the use of the church, to Rev. Jas.

Lyttle for many kindnesses, including the use of his lantern, to the club of the local school for the use of their lantern, to Mr. T. A. McArthur, Inspector of Recorder's Offices, whose room in Swastika I occupied while there, to Mr. Ginn for the use of his office and for attending to the advertising, and to many friends for their unremitting efforts to make the class a success and our stay a pleasant one. In this place as in others the number of men who have a good knowledge of minerals is noteworthy. This class was remarkable in having as one of its members, Miss Fetterly, an experienced practical prospector. On the evening of the last day in Swastika, we were very pleasantly entertained at a social gathering held in the Union Church.

Kirkland Lake

By arrangement with Mr. John Gillan the day class was held in the Miners' Union Hall, and it proved to be a comfortable and commodious classroom. The evening lectures were given in the Union Church (Rev. Jas. Lyttle, Pastor). To the officials of both Labor Union and Church, I wish to tender my best thanks. The day class here was attended by many experienced prospectors, including Miss Gertrude Oakes. Kirkland Lake is an unusually compact mining camp, which made it possible for the officials of a number of the mines to gather at the evening lectures. This made it very interesting for the lecturer, who wishes to embody in this report his appreciation of the compliment thus paid him and also of their warm hospitality. Mr. R. C. Coffey, Manager of the Lake Shore Mine, helped me collect samples of porphyry and lamprophyre and gave me a large specimen of telluride. This material was used at all the remaining places visited. Mr. Porteous, manager of the Hunton-Kirkland mine, gave me specimens of wolframite which were useful in the other places visited. A significant incident of our stay here was a visit from a Shining Tree prospector who wished to get information about the rocks and minerals characteristic of the Kirkland Lake area. He spent several days with us, and took with him a complete set of the mineral and rock specimens.

South Porcupine

On arrival at South Porcupine we were met by Mr. W. A. Donaghue, Mining Recorder, who had made all arrangements for hotel, place of meeting, etc. The classes were held in the Oddfellows' Hall, which proved quite satisfactory for the purpose. We made a visit to the Dome Mines, where we were pleasantly received by the General Manager, Mr. Depencier, who, with the Superintendent, Mr. Dowsett, showed us over the surface features, mill, etc. I have to thank Mr. C. E. Morgan for assistance in collecting mineral and rocks. We got supplies of greenstone, diabase, ankerite, quartz, porphyry and tourmaline (near Clifton mine). Mr. Offer, manager of the Clifton, gave us a considerable quantity of scheelite which occurs there. In organising the classes I had much assistance from Messrs. Donaghue, W. G. A. Wood (Crown Timber Agent) and Morgan. Here, as in other places, it was noticed that many of the prospectors were acquainted with a considerable range of minerals. Men attended from Dome Mines, Schumacher, and Pottsville. At a Board of Trade banquet held after the classes were closed, I was invited to speak on "Our Mineral Industries."

Timmins

By arrangement with Mayor McInnis and Councillor Longmore, the O.B.U. hall was secured for the day classes, and the Miners' Union hall for the evening lectures. The officials of the Unions gave us their hearty co-operation and assistance in preparing the halls for the work of the classes. The Timmins class was

notable for the large number of active prospectors, some of whom came from considerable distances, two from Hearst. The hour for the day class was set to suit one of the mine shifts, as a considerable number of prospectors were working in the mines. Two prospectors told me of finding a large piece of float which corresponded with tin-stone samples distributed to the class. Afterwards they sent in samples which were tested and found to be tin-stone. By invitation we visited the Porcupine-Crown, Hollinger and McIntyre mines, and have to thank managers Stewart and Ennis, Mr. Webb, Manager of the Hollinger stores, and engineers Bell, Robinson and Longmore for making these visits pleasant and interesting. We collected supplies of quartz-porphyry and feldspar-porphyry. In all the classes held in the gold areas great stress was laid on porphyries by careful examination of specimens by the class, by definitions, and by microphotographs shown in the evening lectures. As porphyries are associated with the ore bodies in all our new gold fields, it was thought important for the prospectors to have clear ideas on that subject.

Elk Lake

The Council had selected as meeting places for the classes the council chambers for the day class and the school house for the evening lectures. Mr. M. R. Morgan, Mining Recorder, helped us make preparations for the classes and was kind enough to allow me the use of his office for writing letters, etc. I have also to thank Col. H. E. McKee, and Messrs. D. J. Giles, McKinley, and A. P. Campbell for assistance in collecting supplies of minerals and rocks from the Beaver, Silver Alliance, and Blight properties. Bornite, malachite, micaceous hematite, diabase, gabbro, and epidote were obtained. Mr. Frank Wescott gave me some pieces of very pure "kidney" hematite from his new discovery in Montrose? township. Many prospectors were noted on their way up the Montreal river to the Matachewan region. Large numbers were also going into Bruce township, and some claims were staked for gold in Midlothian township.

North Bay

Most of the prospectors who formerly made North Bay their headquarters have moved out, probably gone farther north. But it was thought worth while holding a class there as an experiment. While the attendance was small the result, in increasing the interest in exploration for minerals, was encouraging. Special stress was laid on the advisability of prospecting for minerals other than gold and silver, particularly those that might occur in granite and gneiss. By arrangement with Mayor Ferguson, the classes were held in the fine Normal School building, where Principal Casselman and his staff gave us every facility and made us very much at home. I have also to thank Messrs. Barry Shephard, G. Galvin, and C. G. Watson for many kindnesses, and much help.

General

If the many expressions of appreciation are taken as a fair indication of the value of this work, there can be no doubt about the advisability of continuing and elaborating it. The old days of prospecting by pure chance methods are passed. The prospector of to-day studies the geological maps and reports, and uses them intelligently. He is eager to enlarge his acquaintance with mineral species and rock formations, and to improve his methods by making them more scientific. Prospecting is becoming more and more a profession, in which, however, there will always be room for those of various degrees of scientific education. Advance in mineral industries depends primarily upon the prospector. If he stops work, there

is no more progress. This only needs to be stated, and it at once follows that the profession of prospecting should be carefully nurtured, first by providing adequate facilities for education and second by such economic practice as will ensure a fair return to the prospector—a living wage. He invests his time, money and skill as the pioneer adventurer in mineral development.

Suggestions

At the present stage it does not seem possible to use the ordinary systems of education to meet the case of the prospector. In some way he should get the elements of chemistry and physics—just the essential ideas of these subjects, without the elaboration and detail of the ordinary textbook. This would be the foundation for the study of minerals and rocks, and the essentials of geology and ore deposits. All this can be done in winter, when prospecting is mostly held up. By means of summer field classes the prospector could be instructed in field geology, note-keeping and sketching. This should be done by instructors who are field geologists with some experience in prospecting. A great deal can be accomplished even in a few days of such instruction. The prospector needs only a start. He can be trusted to go on by himself. There are certain facilities for self-education which may be usefully provided. In a number of places where classes were held, the public librarian has adopted the idea of a prospectors' corner or section, where books and reports will be found specially interesting to prospectors. This movement should be encouraged so that in every centre where prospectors make their headquarters they may count on finding the right books, maps, etc. In such places mineral and rock collections may be placed. These should be rather different from the ordinary collections—they should be particular and not general—illustrative of the rocks and minerals of the district. Special collections of gossans, stains, and other "signs," and minerals with their associated rocks, should be made, with the minerals they indicate—all so placed and described in large print that the student may be able to readily take in their meaning. Occasional illustrated lectures by members of the Department of Mines staff and others might be given in such places on subjects of current interest, for example on new discoveries of economic importance.

While it seems hardly possible to utilize the ordinary educational facilities, the mining schools in such places as Sudbury and Haileybury might be used in several ways. The collections mentioned could be housed there, the prospectors' classes and lectures might as a matter of course be held in the same place, and the teacher of geology in the mining school might be engaged to instruct field classes in the summer.

This is hardly the place to discuss the immediate return the prospector should get for his work. It is a very difficult subject, but those most interested should address themselves to it. The present conditions are hardly satisfactory. Many of the best prospectors are becoming discouraged. There is a good deal of chance in the business, and some scheme should be devised for carrying over those whose lucky strike is slow in coming.

Investment in prospecting is subject to the same uncertainties as are found in other business. The credit system is used in the latter and as the business goes on a living is taken out of it. The same idea applied to the independent prospector should in some way give him his living and enable him to go on until he made his strike.

In conclusion it is suggested that the places for holding classes should be selected at an early date so that the whole list with dates of beginning may be published in newspapers. This will enable the prospectors to arrange their business so as to reach the selected place in time.

THIRD REPORT OF JOINT PEAT COMMITTEE¹

By

B. F. Haanel, Secretary

The investigation being conducted by the Peat Committee appointed jointly by the Government of Canada and the Government of Ontario is concerned with the determination of the feasibility of manufacturing peat fuel on a commercial basis in Canada under present conditions.

The Anrep and Moore Machines

Following plans of action decided upon by the two Governments which were based on experience gained from previous operations carried on by the Mines Branch of the Department of Mines of the Federal Government and by private parties, two machines, one known as the Anrep machine, and the other as the Moore machine, were constructed and installed on the peat bog at Alfred, Ont. prior to the beginning of the season of 1920. Both machines were given a thorough mechanical try-out the previous year, and the design of the Committee was to make a commercial demonstration of both plants during the season of 1920. It was found impossible, however, to operate both plants to capacity, and to take advantage of the full working season.

The Anrep system consists of two main elements, the excavating element, which operates as a unit by itself, and the spreading element. The spreading system employed with the Anrep machine, which has always been considered an inseparable and most important part of the Anrep method of manufacturing peat fuel, consists of a square track layout with rounded corners around which cars, operated by a cableway actuated from the power plant situated on the excavator element, deliver the pulped peat to a spreader, which is operated at right angles to the line of travel of the excavating element.

With this system nine men are required to load cars and spread the peat on the field, and, in addition to these very high labour costs, a serious loss of time is also occasioned by the necessity for moving the tracks, an operation which must be performed at stated intervals to keep march with the forward motion of the excavating element. In the operations during the season the capacity of this plant was also reduced owing to the difficulty encountered of delivering a continuous supply of cars to the spreader.

The principal innovations in the Moore system are, the unique device employed for delivering the pulped peat to the spreader and laying it on the drying field, and the method of excavating the raw peat. The former is accomplished by delivering the pulped peat from the macerator continuously on to a belt conveyor, which is supported on a bridge work some 160 feet long attached to the main peat machine at right angles to its direction of travel. The delivery and spreading of peat is, therefore, continuous and automatic; but unlike the Anrep system the peat is spread parallel to the direction of travel of the excavating element. As a result, the Moore system requires a much greater length of working face than the Anrep system, in order to lay its full season's production on the field; but the number of men required to operate it to full capacity is very much less than in the Anrep system.

Operation of the Plants

Both plants were worked during the entire season, although not continuously, the Anrep plant being operated on that portion of the field which had been pre-

¹ See also First Report Joint Peat Committee, Bur. Min. Rep. Vol. XXVIII, 1919, Pt. 1, pp. 187—192, and Second do, Vol. XXIX, 1920, Pt. 1, pp. 142—156.

pared several years, and which was, consequently in condition for manufacturing peat fuel to the best advantage. The Moore plant, on the other hand, was operated on that portion of the bog lying adjacent to the C.P.R. tracks which had not been drained and was, therefore, inferior to the other portion of the field. This handicapped the Moore machine seriously; but it was the desire of the Peat Committee to give the Anrep unit every possible advantage in order to prove its value, since it was of standard design as regards the principles employed in excavating and spreading, and it was contemplated that the Moore machine would require a great many alterations before it could be put in working order. Notwithstanding the handicaps under which the Moore plant operated, it became manifest early in the operations that this plant would not have to be seriously altered in order to put it in good working shape.

Between 5,000 and 6,000 tons of air-dried machine peat fuel with approximately 25 per cent. moisture were produced during the season of 1920, the greater portion of which was sold to householders in Ottawa, Peterborough and other cities and towns and a certain portion sold for commercial purposes.

Results So Far Obtained

Although it is not yet possible for the Peat Committee to say whether peat fuel can or can not be manufactured on a commercial basis, they can definitely state, as a result of the investigation so far conducted:

1. That the Anrep plant as it stands is in no sense commercial.
2. That the Moore plant under certain conditions can be employed commercially for the manufacture of peat fuel.
3. That the Anrep excavating element is the superior of the two and the logical one to employ, while
4. The Moore spreading system is much more efficient, and is the logical spreading system to employ.

The main difficulty with the Anrep machine is the high cost of labour of the spreading system, and the large amount of time lost on changing tracks and in delivering a continuous supply of peat to the field, resulting in reduced capacity. The main difficulty with the Moore system is the excessively long face working which is required, an inherent difficulty which prevents this type of machine from being employed intensively on the average bog.

Combining Best Features of the Two Methods

In order to manufacture peat fuel on a large commercial scale during the comparatively short working season, it is absolutely essential that the bog be worked intensively, that is to say, that the largest number of units practicable be employed. This can only be accomplished by employing an excavator of the Anrep type combined with a spreading system of the Moore type, and moreover, it is essential that all manufacturing units be driven by electric motors supplied with current generated in a central station, which will effect a further reduction in costs.

On the strength of the results which the Peat Committee have obtained up to the present time, and after very careful consideration of the same, they recommend that the Anrep excavating element, which requires no alterations and is in as perfect condition as it is possible to put it, be combined with the Moore spreading system. This spreading system, in order to meet the requirements of the Anrep excavating machine, will have to be specially designed inasmuch as the bridge work which will operate the belt conveyor will be some 850 feet long. The bridge work carrying the belt conveyor at right angles to the direction of travel of the ex-

excavator will move parallel with the excavator. The belt conveyor will deliver the pulped peat to a spreader which will lay it in 800-foot rows parallel to the bridge work and at right angles to the line of travel of the excavator.

The designs for this new spreading system have already been thoroughly worked out, and are sufficiently complete to be placed in the shop for fabrication. With this new element the Anrep excavator will be permitted to work at full capacity throughout the working hours and deliver pulped peat continuously to the spreader. While no attempt will be made to describe this transportation system in detail, it should be pointed out that the design of this new system required a large amount of work and expert advice, and, in order to reduce the chances of failure to as great a degree as possible, the Peat Committee enlisted the expert opinion of engineers and companies of experience in belt conveying systems used for various purposes.

It is also the intention of the Peat Committee to operate the Moore plant, as it stands, continuously throughout the season of 1921 on a strictly business basis, with the minimum complement of men and without the attention of the expert engineering staff. This plant then will serve, first, as a demonstration plant for those who are desirous of witnessing the manufacture of peat fuel, and second, will also enable exact figures of costs of manufacture, harvesting, etc. to be obtained.

—It is imperative that the combined plant above mentioned be erected, mechanically tried out, and commercially demonstrated before the Peat Committee can offer a definite opinion regarding the feasibility of manufacturing peat fuel on a commercial scale in Canada; but it must be understood that even though the equipment is placed on the field early next season, it will be absolutely impossible to do more than operate it to determine weaknesses and changes which may have to be made in the design and to give it a thorough mechanical tryout, at the same time of course manufacturing a small quantity of fuel. The commercial demonstration of the combined plant cannot possibly be made until the following season, and its commercial feasibility may not even be determined at the end of the same, but the Peat Committee have every reason to believe that the operation of the plant during the season of 1922, will afford sufficient data to enable the Peat Committee to decide definitely whether or not peat fuel can be manufactured on a commercial basis at a profit under conditions existing in Canada at the present time.

Small Plant For Local Manufacture

In addition to the above programme of work the Peat Committee have constructed a small peat machine which can be operated by two men and a boy, or say three men, for the purpose of supplying farmers or groups of farmers with a cheap, satisfactory fuel for their own immediate use, or for the use of the inhabitants of villages and small towns. This machine is constructed and partially erected, and its utility for the purpose for which it was designed can be determined without difficulty in a very short time. This part of the work will proceed along with the other.

The problem, therefore, with which the Peat Committee is confronted, and which it hopes will be solved at the conclusion of the season of 1922, resolves itself principally into the design of a machine which will be capable of manufacturing a large quantity of peat fuel during a comparatively short working season, with the minimum employment of manual labor, and at a cost which will permit the fuel so manufactured to compete with coal at existing prices. The present-day conditions which the Peat Committee have to meet are; greatly increased labor costs—twice and in certain cases three times what they were prior to the war—and greatly increased cost of materials and machinery and general plant employed. Costs have mounted to two and three times the figures prevailing prior to the war. These conditions, coupled with unstable labour market and great difficulty in getting

plant fabricated and delivered at the required time, are mainly responsible for the time absorbed in the investigation and have severely handicapped the Peat Committee's efforts.

A Short Working Season Inevitable

It has been appreciated by all investigators who have devoted their time and attention to the manufacture of peat fuel that the development of the peat resources of the world would be greatly enhanced if operations could be conducted throughout the entire year. Numerous costly investigations and experiments have been made both in Europe and on this continent with that end in view. The net result of such operations, however, up to the present time is that although millions of tons of peat fuel are produced annually in Europe, the only process which has proved of economic value for operations on any practical scale is that which depends upon the sun and wind for the removal of the large quantity of excess moisture contained in the raw peat. This process is, therefore, the result of all the efforts which have been made by investigators for a period covering more than a century to utilize peat for fuel purposes.

The Peat Committee is not attempting to alter the process itself, but is rather directing its efforts to the development of more efficient and more economical means of conducting the various operations of which it consists, in order to meet the special conditions as to cost of labour, etc., prevailing in this country.

An Expert on Committee's Work

It may be stated that the direction and scope of the Committee's operations up to the present time have commended themselves favourably to European investigators of wide experience and knowledge of actual conditions prevailing in the industry, and of the successful commercial manufacture of peat fuel in the various countries where its production has been carried on upon any large scale. Prof. Pierce F. Purcell, of Dublin, Ireland, who is conversant with peat operations throughout Europe, and who recently visited Canada as special investigator for the British Fuel Research Board, after careful study of the plant being developed and the methods being used by the Committee at Alfred for the production and harvesting of peat fuel, made the following statement:—

That the Fuel Research Board were convinced of the value of the work being carried out here is, I think, evident from the fact that they have sent me to Canada specially to report on the work carried on at Alfred. I have now spent some time at Alfred, and I think it is only right that I should say that in my opinion the work carried out there is in advance of any work which to my knowledge has been done elsewhere.

It may be of value here to state that the peat-using countries of Europe are, like Canada, handicapped by a short manufacturing season, yet, in spite of the short season, a very large portion of the fuel requirements of certain of the European countries is supplied by peat fuel. For example 60 per cent. of the fuel requirements of Ireland are supplied by the manufacture of hand cut, air-dried peat fuel; while in Denmark alone the annual production of peat fuel is estimated at over a million tons. Sweden, similarly, produces large quantities of peat fuel, in fact uses peat powder as a fuel on one of her state railways. Before the war Russia manufactured very large quantities of peat fuel, according to some authorities as high as six million tons, and other European countries, notably Holland, Germany and Italy, use peat fuel in industrial plants as well as for domestic purposes. It is therefore reasonable to assume that under similar conditions Canada could manufacture sufficient peat fuel to largely decrease the quantity of coal which it is now necessary to import annually.

Inasmuch as the investigation is in no sense complete and certain essential data have not yet been determined, it is not advisable to state an estimated cost, largely based on assumptions, of manufacturing a ton of peat fuel. The cost of manufacturing peat fuel can, therefore, only be definitely stated at the close of the investigation.

NOTES ON CLAYS OF THE MISSINAIBI RIVER

By Joseph Keele

Introduction

In the summer of 1919 the writer examined the clay and shale deposits exposed along the banks of the Abitibi and Mattagami rivers. The most important result of this exploration was the discovery of fire clays of Lower Cretaceous age on the Mattagami river.² Apart from the probable economic value of the fire clays, the fact that rocks of Mesozoic age occur in northern Ontario is of considerable scientific interest as the existence of any such rocks was hitherto unsuspected in this region.

During the summer of 1920 a short journey was made down the Missinaibi river from Mattice, a station on the National Transcontinental railway, but owing to unforeseen circumstances only a part of the proposed examination was accomplished.

The Missinaibi river joins with the Mattagami and Abitibi to form the Moose river which flows into James Bay. It has sunk its bed in the great sheet of glacial drift which overspreads the entire region. A detailed description of this drift sheet is given in Part II of the Ontario Department of Mines report for 1920.



Fig. 1—Round bay, Missinaibi river, looking south from high bank of glacial drift toward the pre-Cambrian escarpment. The Paleozoic plain begins here and reaches to the shores of Hudson Bay.

There are frequent exposures of bedrock, the schist complex of the pre-Cambrian, in the river bed for a distance of 40 miles below Mattice, but below this there is no hard rock exposed.

Pleistocene or Glacial Clays

Boulder clay or till.—A sheet of boulder clay extends over the greater part of the region and conceals the underlying bedrock or any deposits of an earlier date

¹ Ceramic Engineer, Dept. of Mines, Ottawa.

² Report Ont. Dept. of Mines, 1920, Vol. 29, Part II, pp. 31-55; Geol. Survey of Can., Summary Report, Part D, 1920.

except at certain points where the river has cut down far enough to reveal them. This material consists of a mixture of a clay and silt, sand, gravel and stones with some very large boulders also embedded in it. One of the most striking features of the Missinaibi river is the quantity of large boulders scattered over its bed which in low water stages impede boat navigation to a considerable extent. These boulders have been released from the till sheet by the river, but are too heavy for it to move down stream. The boulder clay has no special economic value except that a very good soil forms on its surface, and pioneer farming operations have now reached the river banks.

Glacial lake clays.—There are occasional depressions in the boulder clay surface which have become filled with stratified stoneless clays, and these are the kind of clays sought by brick and tile makers; the boulder clay being utterly unsuitable for this purpose. A fairly extensive deposit of the stratified clay occurs on the west bank of the river on John Christianson's ranch. It is from 4 to 15 feet in thickness and is underlain by fluvio-glacial gravels. These gravels were used for the construction of the concrete abutments of the railway bridge across the river at this point.



Fig. 2—Stratified clay overlying boulder clay on creek bank $\frac{1}{4}$ mile east of Mattice station, National Transcontinental Railway, Algoma district.

A small creek which crosses the railway about half a mile east of Mattice station has been cut down through a deposit of stratified clay as far as the underlying till, a depth of 8 feet. This deposit (Fig. 2.) consists of alternating layers of ash-colored silt and brown plastic clay. In the middle and lower part of the section there are occasional small pockets of coarse gneissic grit, and individual pebbles are scattered all through the deposit. The underlying till, which forms the bed of the creek, is a compact bluish grey clay containing numerous cobblestones and boulders.

An average sample of the stratified clay was collected for testing. It was found to work up well when wet and was plastic enough to make brick or even tile. It burns to a cream or light buff-coloured body with a total shrinkage of 6 per cent. Like all clays with a high lime content, it has a rather porous burned body but the

strength is sufficient for any kind of structure. Unfortunately, some of the pebbles scattered through the clay are limestone and these are detrimental to burned clay wares. Some of the burned test pieces are spalling on this account. A good deal of this trouble may be avoided, however, by using only the upper 4 feet of the deposit which contains fewer pebbles than the lower portion.

The upper 18 inches of the deposit is weathered, and the greater part of the lime is leached out of this portion. A separate sample of the top clay was found to have very stiff plasticity, a rather high shrinkage and to burn to a dense body of good red colour. This is an altogether different product from that which the bottom clay gives, the difference being due to the effect of weathering. This clay would be suitable for the manufacture of red and buff building brick or for field drain tile, but care should be taken to avoid those parts of the deposit containing pebbles.



Fig. 3—Post-glacial gorge cutting in the pre-Cambrian schist complex, Missinaibi river, Conjuring House chute.

There is not much opportunity for examining the river banks below Mattice as they are generally low and wooded almost to the water edge, but the few outcrops seen were stony clay, and the multitude of boulders that are strewn on the river bed would seem to indicate that the river banks are mostly boulder clay. The frequency of bedrock outcrops and the network of boulders on the river bed have kept the Missinaibi from cutting downward like the Mattagami or Abitibi, whose banks are high and show plenty of drift outcrops, the Missinaibi still practically flowing on the surface of the land. Its activity is apparent, however, when approaching the northern edge of the pre-Cambrian rocks where the post-glacial gorge cutting is proceeding on the same vigorous scale as on the other large rivers of the region (Fig. 3).

North of the pre-Cambrian rock border the river flows in a deep trench cut in the glacial drift and other soft rocks. On Round bay, an expansion of the river 45 miles north of Mattice and about a mile north of the last outcrop of pre-Cambrian rocks, the drift section at one point is made up as follows:

Gravel	2 feet
Stoneless clay and silt	10 "
Boulder clay	30 "
Stratified silt and sand	10 "
Very fine grey sand unstratified	20 "
Concealed	30 "
<hr/>	
100	

Generally speaking the boulder clay predominates along the banks of the river, but generally the boulder clay predominates along the banks of the river.

There were two distinct periods during Pleistocene times in northern Ontario when land ice occupied the whole region. The ice completely withdrew between these periods, and erosion, sedimentation and plant growth went on as they do to-day. The materials laid down after the withdrawal of the first ice sheet and before the advance of the next one are called "interglacial." The last advance of the ice removed or destroyed most of the material accumulated during the interglacial age, but there are still some quite imposing remnants. Only two outcrops of interglacial measures were seen by the writer. One of these was on the east side of the Missinaibi river just below the northern end of the Long portage. It consists of the following materials:

	feet	inches
Boulder clay—Late Glacial	10	0
White and rusty sand }	40	0
Interglacial		
Laminated peaty clay	1	6

The laminated clay contains a great quantity of biotite particles which gives it a black colour, but some of the layers are lighter in hue. There is an occasional layer of limonite about half an inch in thickness. Toward the bottom of the deposit thin layers of peat are interlaminated between micaceous silts. This clay is much harder than the late glacial stratified clay such as the one described from Mattice, and it resembles shale in some respects. This deposit has no great lateral extent as it lies as a filling in an old valley in the pre-Cambrian bedrock which was probably a pre-glacial river channel. The base of the stratified clay was not exposed. No clay of this description was seen below this point for a distance of 40 miles where a more complete series of interglacial beds outcrop on the east side of the river, about 4 miles above the mouth of the Sowska river. The section here consists of:

Stratified olive plastic clay	2 feet
Compressed peat	3 "
Yellow sand and gravel with lenses of till	12 "
Brown till	6 "
Yellow stratified sand and gravel	9 "
Hard reddish brown till to water edge	6 "

This section is not uniform throughout the deposit, as there are two layers of peat separated by 2 feet of stratified sand and clay in another part of the section, and the peat lies both on till and on gravel. The yellow stratified sand and gravel is replaced by stratified fine-grained olive clays with films of limonite, similar to the clay near Long portage. These materials are overlain by the late glacial till, and this till forms the entire banks above and below the interglacial remnant. These were the only two outcrops of interglacial beds seen by the writer, but there are more extensive deposits of similar materials farther north on the Missinaibi river,

¹ Ont. Bur. Mines Rep., Vol. 13, 1904, Part I.

and also on its tributary streams the Wabiskagami and Soveska, which have been examined by J. M. Bell¹ (Fig. 4). The deposit of interglacial clay at Long portage has never been described before and it is the most southerly occurrence of this kind of clay known in northern Ontario.

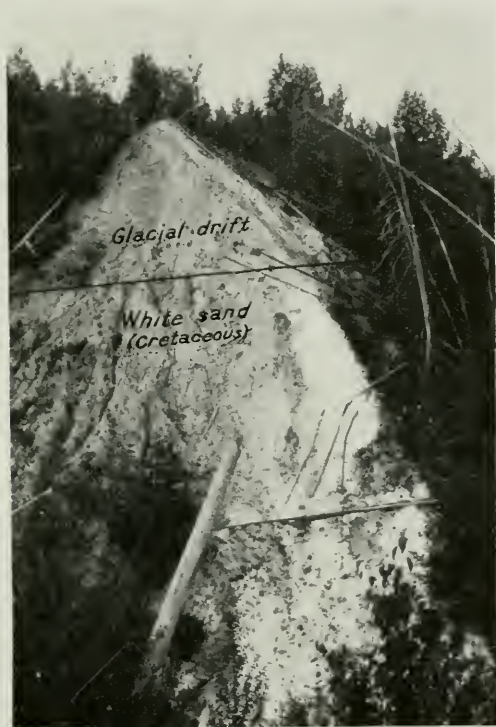


Fig. 4—White Cretaceous sand under boulder clay on Missinaibi river, 4 miles above mouth of its tributary, the Wabiskagami river.

The interglacial clays have no special value in a remote region like this, because they are not high grade materials which would stand transportation charges, such as the Cretaceous clays described below. They are better brick clays, however, than the late glacial clays such as the deposit at Mattice. The best brick clay in southern Ontario is an interglacial clay which occurs in the vicinity of Toronto. It has certain characteristics in common with the interglacial clay on the Missinaibi, so much so that Coleman is of opinion that the two sets of deposits were probably formed at the same period.¹

¹ Interglacial Periods in Canada—Compte Rendu, Cong., Geol. Intern. Mexico, 1906.

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Ontario Gold Deposits
Their Character, Distribution and Productiveness
By
PERCY E. HOPKINS

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Sample of gold ore (natural size) from between the sixth (550-foot) and seventh (700-foot) levels of the Dome mine, Porcupine.

ONTARIO GOLD DEPOSITS ¹

THEIR CHARACTER, DISTRIBUTION AND PRODUCTIVENESS

By

Percy E. Hopkins

Gold mining at the present time is receiving renewed attention in Ontario. Abundance of labour, reduction in mining costs, and the premium on gold are chief causes of the stimulation. In 1920 the exchange premium received by Ontario's gold mining companies was \$1,376,275 or 11.7 per cent. The success or failure of Ontario's gold mining industry, however, is not dependent on the premium, the rate of which is, at this time, declining rapidly.

It is the purpose of this paper to give an historical summary of gold mining in Ontario, and to describe, as succinctly as possible, the geological features of the several gold fields as related to the ore deposits. Notes on the character of the deposits themselves, their production and development will naturally be included. The mining claim numbers, and the important literature of each area have been given.

Accompanying the paper are index maps showing the location of the producing gold mines and of many gold prospects. Railway stations and wagon roads, together with hydro-electric power plants and transmission lines serving the gold mining industry, are also shown. The maps were drawn by H. C. Smith, cartographer of the Ontario Department of Mines. I wish to express my appreciation to W. R. Rogers, statistician of the Ontario Department of Mines, for his kindness in furnishing statements of gold production. I am also specially indebted to Dr. W. G. Miller, Provincial Geologist, and T. W. Gibson, Deputy Minister of Mines, for numerous suggestions.

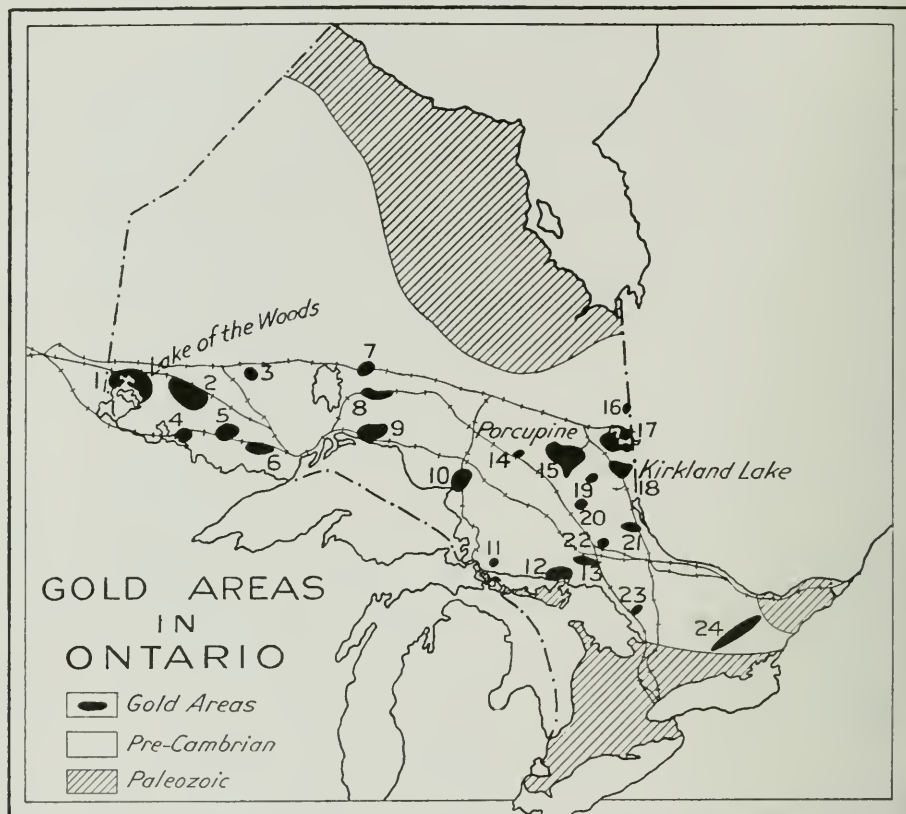
History

Gold was first discovered in Ontario in 1866, at the Richardson location, Hastings county, southeastern Ontario.

Curiously enough, the Richardson deposit was far from being typical of Ontario gold mines, either of the locality in which it was found or elsewhere. The original account of the discovery is given by H. G. Vennor in the report of the Geological Survey of Canada 1866-69, page 165 *et seq.* Mr. Vennor, who in May 1866 began the work of geological exploration in Hastings and adjoining counties which he carried on for several years, had instructions to take "particular note of all mineral deposits of economic value." He states:

In the early part of August, 1866, while exploring in the neighborhood of Bannockburn village, in the township of Madoc, I was informed that a metal, suspected to be gold, had just been taken from an opening in the eighteenth lot of the fifth range of the township, on the property of Mr. J. Richardson. A visit was at once made to the locality and the lot was found to be the same as that on which openings had previously been made for copper ore, described in Mr. Macfarlane's Report of 1866, (p. 106). Mr. Richardson informed me that a person named Powell, and an old Dutch miner, had lately found flakes of yellow metal resembling copper, which he could beat out into thin leaves. At my request he showed me the specimens which he had collected, and I at once informed him that the metal was gold.

¹ Paper presented in abstract at the annual meeting of the Canadian Institute of Mining and Metallurgy, March, 1922.



MAP OF ONTARIO SHOWING THE LODE GOLD AREAS.

- | | |
|---|--|
| 1. Lake of the Woods and West Shoal lake. | key lake. |
| 2. Eagle Lake, Wabigoon or Dryden, Manitou and Sakoose. | 13. Long lake and Sudbury. |
| 3. Sturgeon lake. | 14. Tionaga. |
| 4. Mine Centre, East Shoal lake or Lower Seine area. | 15. Porcupine, Cripple creek, Night Hawk lake and McArthur township. |
| 5. Atikokan or Upper Seine area. | 16. Patten river (only assays obtained here). |
| 6. Huronian and Shebandowan lake. | 17. Painkiller lake, Rickard, Abitibi lake and Lightning river. |
| 7. Kowkash and Tashota. | 18. Kirkland lake, Larder lake, Boston creek, Swastika and Bourkes. |
| 8. Jellicoe, Kinghorn and Little Long lake (only a few assays have been obtained from this area). | 19. Matachewan. |
| 9. Schreiber, Duck lake and Jackfish. | 20. West Shiningtree. |
| 10. Michtipicoten and Goudreau. | 21. Timagami. |
| 11. Ophir or Havilah (Galbraith township). | 22. Wanapitei. |
| 12. Shakespeare, Howry creek and Whis- | 23. Parry Sound. |
| | 24. Southeastern Ontario (Peterborough to Lanark county). |

Mr. Vennor describes the opening from which the gold was taken as being on the east end of the lot, and containing an irregular layer of chlorite and epidotic gneiss, which was overlain by a band resembling an impure steatite, the whole dipping N. 5° E. at an angle of 45°. The seat of the gold appeared to be a crevice of longitudinal ovoid form, about 4 feet below the surface, filled with reddish-brown ferruginous earth, in which were scattered fragments of a black carbonaceous matter, the latter showing when broken, small flakes or scales of the metal. Fresh blasts were made during Mr. Vennor's stay, but no further development of the precious metal resulted. Later, in October, on returning to the mine, Mr. Vennor found that at a depth of 15 feet, another open crevice had been struck, which beyond doubt proved rich in the metal. From the ferruginous carbonaceous earth, Mr. Vennor himself obtained by washing and amalgamation 25 pennyweights of gold. He observed no gold in the solid rock, but shortly afterwards, some "very beautiful and rich" specimens were displayed to him, in which the gold was enclosed in the dolomite and calcspar.

Powell himself, the discoverer, confirms¹ the story of the crevices. He was following on a seam for copper, and at a depth of 15 feet struck ore carrying free gold. The seam was 6 inches wide at the top and was decomposed for 6 feet, then it was solid rock to 15 feet, "when it suddenly opened out into a cave 12 feet long, 6 feet wide and 6 feet high, so that I could stand upright in it." The gold was found in the rocks of the roof, walls and floor, in the form of leaves and nuggets, and in the roof it ran through a foot thickness like knife-blades. The largest nugget was about the size of a butternut. Powell and his associates disposed of their interest in the discovery for \$36,000, but there is no record of the amount of gold taken from the deposit. This discovery attracted a large number of prospectors, who over-ran the neighborhood during the summer of 1867, and whose rough and ready ways necessitated the organization of a squad of mounted policemen, 25 in number, in March of that year; they were discharged in September. Gold was found in several of the surrounding townships, but the rich deposit on the Richardson farm was not duplicated.

In the Hastings area gold has been produced spasmodically up to the present from numerous properties, the principal being the Deloro and Cordova.

The first important discovery in northwestern Ontario was made by Peter McKellar in 1871, at what was afterwards known as the Huronian mine, Moss township. In 1872, gold was found on an island in Partridge lake. This was followed by many other discoveries in the Lake of the Woods district where the chief mines were the Sultana, Mikado, and Regina. In 1875 small nuggets of gold were found on Victoria cape, near Jackfish, Lake Superior. The discovery of gold on the United States side of Rainy Lake in 1892 resulted in prospecting soon being extended into Shoal Lake, Seine river, Manitou, Sturgeon lake, and other neighboring areas. The gold boom of northwestern Ontario reached its peak in 1897, resulting in many unwarranted stamp mills being erected. Inefficient management and stock-jobbing operators caused the loss of much capital; nevertheless certain mines—the Sultana, Mikado, and Regina—produced from about one-half to three-quarters of a million dollars each.

Gold associated with copper was found at the McGown property, two miles east of Parry Sound, in 1894, but little production resulted. In 1895 and 1896 the precious metal was discovered on the north shore of Lake Superior, at Jack-

¹ Rep. Ont. Bur. Mines, Vol. III, 1893, p. 54.

fish and Schreiber, respectively, and the area was enlarged in 1914 by the discovery of gold at Duck Lake, 18 miles north of the latter place. From 1892 to the present time, isolated properties, situated near Wanapitei and Sudbury, and westward along the north shore of Lake Huron, have had a small production; these include the Crystal, Ophir, Shakespeare, Long Lake and others. In addition, a small quantity of gold is recovered from the nickel-copper ores at Sudbury. Since 1902, three or four mines have produced in the vicinity of Wawa, Michipicoten, where gold was found in 1897, but they are now lying idle. Of these, the Grace mine is best known. East of Goudreau on the Algoma Central railway gold was found in 1918, and in 1921 the Murphy claims were staked out southwest of that station.

The discovery of silver at Cobalt in 1903 brought hundreds of prospectors into northeastern Ontario. From 1905 to 1918 important gold areas were found annually. They are as follows: Playfair, 1905; Abitibi and Larder Lake, 1906; Night Hawk Lake, 1907; Painkiller, 1908; Munro and Porcupine, 1909; Swastika, 1910; Howry Creek and West Shiningtree, 1911; Whiskey Lake and Kirkland Lake, 1912; Boston Creek, 1914; Kowkash-Tashota, 1915; Matachewan, 1916; Rickard and Lightning River, 1917; Bourkes, 1918. In addition to these areas, many small gold discoveries have been made in other localities.

Porcupine is by far the largest producer, the principal mine, the Hollinger Consolidated being one of the great gold mines of the world. Kirkland Lake area is next in importance. Ontario now leads the other provinces of Canada, and every state in the United States, excepting California, in production. Ontario produced 74 per cent. of Canada's gold production in 1920. There is every reason to believe that Ontario's gold production will continue to increase for some time. Gold is so wide-spread and the production is so substantial and increasing so rapidly, that it seems fitting to name Ontario the "Golden Province."

Production

The total gold production of Ontario up to the end of 1920 was \$73,173,463, all of which came from pre-Cambrian deposits. From 1892 to 1911 the total production was small, the greatest output for any year being \$424,568 in 1889. During these years the Sultana, Mikado, and Regina were the principal producers. Gold has been recovered as a by-product from the copper-nickel ores mined at Sudbury, where work began in the late eighties. A small recovery of gold has also been made from the Cobalt ores. The Lake of the Woods mines were not active between 1904 and 1911. In 1909, the Laurentian was the only producer.

Up to 1911 gold mining in Ontario was on the whole not profitable. Since then the industry has flourished, owing particularly to Porcupine, and, to a less extent, to Kirkland Lake. The 1913 production, \$4,558,518, almost equals the entire output up to that year from the time gold was first found in the Province in 1866. In 1920 the gold production exceeded the silver output for the first time since Cobalt was discovered in 1903. The gold production of Ontario for 1921 will likely amount to about fourteen million dollars. For the first nine months of the year it was valued at \$9,818,073. Ontario is the only important country whose gold production has not decreased in the last four years. The world's maximum production of 468.7 million dollars in 1915 has steadily de-

creased to 339.4 million dollars in 1920. The table which follows shows the yearly and total gold production of the Province up to the end of 1921, as published by the Ontario Department of Mines.

GOLD PRODUCTION OF ONTARIO.

Year	Ounces	Value\$	Year	Ounces	Value\$
1866-1891	9,200*	190,258	1907	3,810	66,399
1892	1,785	36,900	1908	3,465	60,337
1893	1,695	32,960	1909	2,042	32,445
1894	2,022	32,776	1910	3,619	68,498
1895	3,030	50,281	1911	2,062	42,637
1896	7,154	121,848	1912	102,278	2,114,086
1897	11,412	190,244	1913	220,837	4,558,518
1898	16,261	275,078	1914	268,942	5,529,767
1899	27,594	424,568	1915	411,588	8,501,391
1900	18,767	297,861	1916	497,833	10,339,259
1901	14,293	244,443	1917	420,893	8,698,735
1902	13,625	229,828	1918	411,878	8,502,480
1903	10,383	188,036	1919	505,964	10,451,709
1904	2,285	40,000	1920	565,283	11,686,043
1905	5,541	99,885	† 1921	707,509	14,624,085
1906	3,926	66,193	Total	4,276,876	\$87,797,553
*Estimated			† Preliminary.		

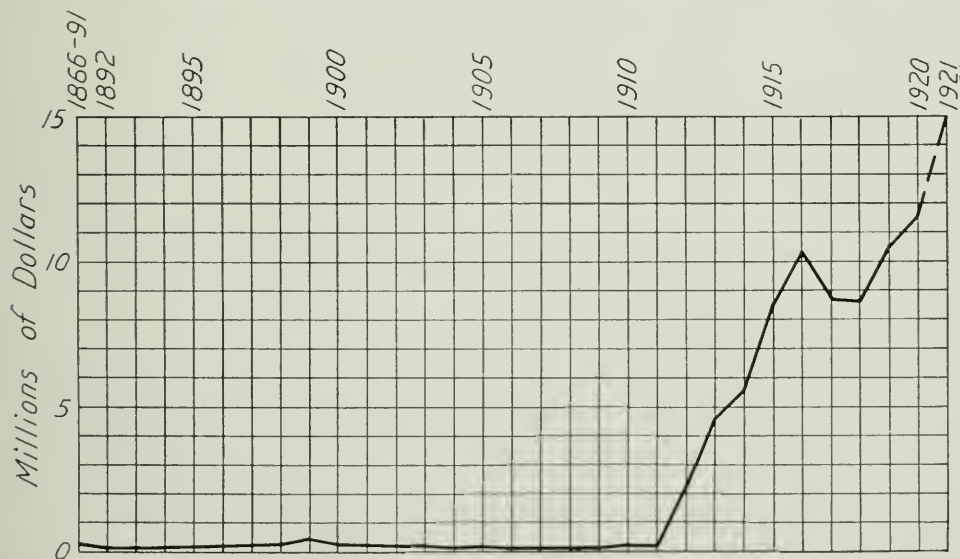


Diagram showing value of gold production of Ontario from 1866 to 1921.

Since dividend payments commenced in 1913, a total up to the end of 1921 of \$23,140,734 has been returned to shareholders by gold mining companies. Ore reserves at the end of 1921 at Porcupine and Kirkland Lake amounted to approximately \$60,000,000.

Pre-Cambrian Geology of Ontario

The vast extent of the pre-Cambrian rocks of Ontario is shown on the accompanying geological sketch map. By far the greater part of the surface underlain by these rocks is unprospected, and much of it is worthy of attention from the searcher for gold deposits.

Gold occurs in many varieties of pre-Cambrian rocks, particularly in those belonging to the Keewatin and Timiskamian series that have been intruded by Algonian granite and porphyry as the Hollinger, Dome, McIntyre and Tough-Oakes. Most of the gold at Kirkland Lake comes from Algonian porphyry, although in places the wall rock is syenite. A small production has come from veins in granite.

Judging from the minerals present, the pre-Cambrian gold deposits of Ontario were formed at great depth and at high to intermediate temperatures. Secondary enrichment has played no important part.



Geological sketch map of Ontario showing distribution of pre-Cambrian rocks.

The most promising gold-bearing rocks of the Province are being gradually mapped, but pre-Cambrian geology is so complex that many years must elapse before detailed maps of the whole can be prepared. The age classification used in this report is that employed by the Ontario Department of Mines, and is as follows:

Pre-Cambrian Epochs of Ontario and their Metal Production¹

(KEWEENAWAN)—	Epoch following basic intrusions of (a) silver, cobalt, nickel, and arsenic at Cobalt and elsewhere; (b) nickel and copper at Sudbury, and copper elsewhere. Certain gold deposits, not now being worked, appear to belong to this epoch.
ANIMIKEAN—	Epoch of deposition of "iron formation" as a chemical precipitate. Includes the Cobalt and other series of sediments.
(ALGOMAN)—	Epoch following granite intrusions, of gold at Porcupine and at many other localities, and of auriferous misspickel. Deposits of galena, zinc blende, fluorite, and other minerals appear also to have been derived from the granites, but some of them were not formed till post pre-Cambrian time.
(HAILEYBURIAN)—	Preceding the intrusion of the Algonman granites, basic intrusives, of post-Timiskaming age, gave rise to nickel and titaniferous and non-titaniferous magnetite deposits and chromite [and possibly gold].
TIMISKAMIAN—	Epoch of minor deposition of "iron formation" as a chemical precipitate, with conglomerate and other sediments.
(LAURENTIAN)—	Granite intrusions probably gave rise to ore deposits which have been removed by excessive erosion, as is known to be the case with deposits of later origin.
LOGANIAN	{ Grenville— Epoch of deposition of extensive "iron formation" as a chemical precipitate, with limestone and other sediments.
	{ (Keewatin)— Composed largely of basic lava flows, many of which are now schistose. There are also acid lava flows such as rhyolite at Lightning river, which gave rise to some gold.

In the table names of epochs that are represented essentially by igneous rocks are enclosed in parentheses.

Gold Epochs

There were probably four epochs of gold deposition during pre-Cambrian times, namely, (a) Keweenawan, (b) Algonman, (c) Haileyburian, and (d) Laurentian and Keewatin.² Erosion has destroyed many deposits. Those now remaining are chiefly of Algonman age.

It is often difficult to determine the epoch in which an ore body was formed. Hence, in the following pages the age given for certain deposits is to be considered only provisional.

Keweenawan.—The gold deposits of the Keweenawan are of comparatively little importance. A few small deposits, not now productive, are apparently genetically connected with Keweenawan intrusives, more especially with the later more acidic facies. They are as follows: the Crystal mine on Lake Wanapitei; the Havilah, formerly the Ophir mine, north of Thessalon; the Sudbury copper-

¹ Ont. Bur. Mines, Vol. XXIV, 1915, pp. 243-248.

² Haileyburian Intrusive Rocks, by W. G. Miller and C. W. Knight, Ont. Bur. Mines, Vol. XXIX, 1920, Pt. 1, pp. 235-236.

nickel deposits,¹ of which the Vermilion mine in lot 6 in the fourth concession of Denison township had the richest gold showing. The Bruce copper mines, which are in Keweenawan diabase and were first worked in 1849, carried in places small quantities of gold, as do also certain cobalt-silver ores which owe their origin to intrusives of this epoch. Portions of the prospects at Howry creek and Whiskey lake are in Animikie sediments and Keweenawan diabase. The Ogema (80 E. and 150 E., Dorion township) and other Keweenawan lead-zinc deposits in the vicinity of Black bay carry small quantities of gold and silver.

Algoman.—Other known gold deposits are presumably pre-Keweenawan in age, since diabase dikes of this age clearly intrude them as at Porcupine, Kirkland Lake, West Shiningtree, Boston Creek, Schreiber, etc. All the known important gold deposits of Ontario appear to have been formed during the Algoman epoch. They are found chiefly in Keewatin, Grenville and infolded Timiskamian sediments which have been intruded by Algoman granite and porphyry. The deposits at Porcupine, Kirkland Lake, Boston Creek, Matachewan, Deloro and elsewhere are believed to belong to this epoch.

Haileyburian.—Certain gold deposits appear to be genetically related to intrusives of this age. The Long Lake gold mine, near Sudbury, is believed to owe its origin to diorite of Haileyburian or Algoman age. The Cordova deposits are found in a gabbro-diabase mass which is post-Hastings in age and may therefore be Haileyburian. The Jamieson deposit in Robb township and the Shaft island deposit on Abitibi lake apparently owe their origin to a diabase-gabbro magma, probably of Haileyburian age.

Laurentian and Keewatin.—Following the intrusion of Laurentian granites and related rocks, doubtless gold deposits were formed that were genetically connected with the intrusives, but they have been removed, for the greater part at least, by erosion. It is difficult to prove that deposits referred by certain writers to this epoch are not of later age. The term Laurentian has been often loosely used; the same may be said of Keewatin. The Foley and other mines at Mine Centre are genetically connected with an altered granite or protogine described as Laurentian by A. C. Lawson, although A. L. Parsons refers to the rock as Algoman. The Ophir, Sultana and Saw Bill occur in a porphyritic gneiss which may be Laurentian. The Goodfish Lake deposits are related to schistose quartz porphyries which may be of Laurentian age. The fact that gold occurs in small quantities in the Keewatin rhyolites at Lightning river and other places would suggest that some of the gold may be of Keewatin age.

Placer Deposits

There are no known gold placer deposits that have been proved to be of commercial importance in Ontario. This may be due to the intense glaciation to which the country has been subjected. However, little systematic prospecting has been done as yet. Attempts have been made at placer mining on the Vermilion and Wanapitei rivers, Metcor lake, Lake Manitou (on claims H.P. 304 and H.P. 384) and Lake Savant, but the ventures were not successful. Low assays in gold can be obtained from glacial sands from various other parts of the Province, such as in Munro, McCool, Montrose, Timmins, and other townships. Where streams have cut through some glacial sands gold can be panned, as for example,

¹ Gold was also found by the Creighton Gold Mining Co., (lot 11, concessions V and VI, Creighton township) in 1889 and a mill operated for a short time in 1893.

in Grassy river. The productive gold deposits of Ontario with which this report deals are primary or lode deposits.

Types of Lode Gold Deposits

Specimens of gold ore may frequently be identified as regards locality by certain characteristics.

(1) According to the minerals present, the deposits may be divided into five classes, namely:

(a) *The pyrite-gold-quartz type*, in which pyrite is the predominant sulphide. The gold usually occurs with pyrite, calcite, chlorite, etc., along crushed seams in the quartz, and associated with pyrite in the mineralized schist. Certain of the following minerals may also be present in minor quantities; copper pyrites, native copper, galena, zinc blende, bismuth minerals, pyrrhotite, magnetite, mispickel, tellurides, molybdenite, scheelite, barite, tourmaline, feldspar, etc. This is the most common and most productive type, as represented by the Porcupine deposits.

(b) *The arsenopyrite-gold-quartz type*, in which arsenopyrite is prominent. The southeastern Ontario, Timagami, Long lake, Howry creek, and some of the Painkiller lake deposits are the only known ones belonging to this type in Ontario. Small quantities of mispickel are present in other types of deposits, such as the Sultana, Pine Portage, Keewatin, Winnipeg Consolidated, Croesus, and McAuley-Bridge in Bristol township. The Beaver Lake deposit in northern Manitoba is of this type.¹

(c) *The gold-telluride veins* characterized by the presence of tellurides. Calaverite and petzite, gold tellurides, are found at the Miller Independence; both calaverite and kalgoorlite occur in No. 3 vein of the Tough-Oakes; calaverite occurs on the Boston-McRae, and petzite has been recognized at the Bourkes mine. Gold-bearing tellurides probably occur at various mines in Kirkland Lake and other places, but so finely disseminated that they are difficult to recognise. Several other tellurides have been found in various parts of the Province and, although they are non-gold tellurides, they frequently indicate rich gold ore, since native gold invariably occurs as veinlets in the tellurides. Altaite is quite common at all the mines of Kirkland Lake, while coloradoite, tetradymite and hessite (?) occur in small quantities. Other known telluride occurrences in the Province are as follows:² sylvanite and nagavagite at the Huronian mine (Moss township); hessite from Gold Creek, Pine Portage Bay, Lake of the Woods, and Powell claim (M.E. 20) in Deloro township; tetradymite from the Mikado mine, Raty claim (Rickard township) and from the Hattie. Treadwell, Mayot, Hill and Cartwright properties at Painkiller Lake. Tellurides not yet identified have been found on the Devanney claim (T.B. 2650) at Tashota, on claims K. 665 and H. W. 443 at Dryden, on the McKellar-Longworth claim (B. J. 122) Schreiber, on the Stitt claims in the centre of Grenfell township, on the Wisconsin-Skead, and on the Malouf, Labine-Smith and other claims on lots 9 and 10 in the second concession of Maisonville township.

(d) *Calcite-gold type*.—Calcite is the principal gangue mineral, there being small quantities of quartz with galena, zinc blende, pyrite, etc., as at the McQuaig and Sjolander-McKirdy claims at Big Duck lake. Some of the veins on the Argonaut (Huronian) are made up largely of calcite.

¹ Pre-Cambrian Goldfields of Central Canada, by J. B. Tyrrell, Trans. Roy. Soc. Can., 1915, 3rd series, Vol. 9, pp. 89-118.

² Ont. Bur. Min. Rep., Vol. XXIV, 1915, Pt. 1, pp. 183-184; Vol. XXVI, 1917, pp. 186, 218; Vol. XXVIII, 1919, Pt. 2; Vol. XXIX, 1920, Pt. 4.

(e) *Copper-nickel-gold deposits*.—Some gold is recovered as a by-product from the nickel-copper ores at Sudbudy. The Whiskey lake, McGown and Skead-Gold deposits are of the copper-gold type.

(2). The shape of the deposit is a minor detail; however, according to form or structure,¹ the deposits may be classified into several groups following the descriptions of various authors who have examined them, namely:

(a) "*Simple*" or "*true fissure*" veins, in which the ore occupies a sheet-like space, with smooth walls, usually in a massive rock; examples, Mikado, Regina, Pine Portage, Foley at Mine Centre, No. 1 vein at Miller-Independence, Clifton-Porcupine, and a portion of the Rea vein at Porcupine.



Gold-bearing quartz stringers in dolomite representing the stockwork type of deposit.

(b) *Composite veins or lodes*, namely, a number of nearly parallel lenticular fissures irregularly connected and spaced over a considerable width with replaced country rock intervening. Most of the productive deposits are of this type. The Hollinger, McIntyre and Dome, the largest known gold ore bodies in Ontario, are of this type. Some of the Kirkland Lake deposits are lode deposits in which the quartz veins are quite narrow.

(c) *Sheeted zone*, e.g. minute fractures closely spaced and parallel. Examples are the Howey-Cochénour at Lightning river, and portions of the deposits in the Kirkland Lake area.

(d) *Stockwork*.—The stockwork type in granite, porphyry, and dolomite or ankerite is common in most gold areas. The Ferguson at Mine Centre, Gold island at Night Hawk lake, and deposits at Larder lake are examples of stockwork in these rocks.

(e) *Fahlbands or Shear-zones*, i.e. schist bands, impregnated with pyrite and other sulphides and containing very little quartz. Examples are Canadian

¹ The gold deposits of Northwestern Ontario were classified by A. P. Coleman in 1896, Ont. Bur. Mines, Vol. VI, 1896, pp. 115-120.

Homestake (Scramble) in northwestern Ontario, Dome Lake and Davidson at Porcupine, the Bosquet at Howry creek and the Currie prospect at Boston creek; the Elstone-Dunkin prospect in Gauthier township approaches this type.

(f) *Pyrite and iron formation*, comprising alternating layers of chert, sugary quartz, magnetite and pyrite, and frequently carrying a little gold. Pits and shafts have been sunk on this type of deposit in almost every gold area. The low gold contents may have been present in the rocks as they were deposited. Where secondary quartz veins intersect the iron formation, gold has in some cases been deposited, the sulphide acting as the precipitating agent for the metal. The Big Master vein, according to A. L. Parsons, shows a remarkable similarity to iron formation. The quartz of the Elizabeth at Atikokan is white and granular, like silica formed in iron formation. Typical examples are the Wright, James, Philadelphia, and Red Dog deposits at Porcupine, and the Cochrane and Gold Corona at West Shiningtree.

(g) *Single lens and pipe-like deposits*.—Portions of the Cordova deposits are pipe-like. The Regina and Mikado have a nearly vertical chimney or short shoot. The Long Lake gold deposit has the shape of a large vertical core or pipe.

Gold-Bearing Veins in Granite and Syenite

As stated above, the bulk of the gold comes from Keewatin basalt schists and Timiskamian sediments which have been intruded by Algoman granite and porphyry. However, gold-bearing veins in granite and syenite are common in certain parts of the Province; some gold has been recovered from fissure veins occurring in these rocks. The main veins on the Regina, Mikado and St. Anthony pass from altered granite into Keewatin schists. The Ophir is in a porphyritic granite. The Foley, Elizabeth and Harold Lake mines have also yielded gold from veins in altered granite called protogine. The U.S. Gold Mining Co., at Sturgeon lake produced a little gold from small veins in granite. Certain prospects like the Hammond Reef and Ferguson, etc., are stockworks in altered granite. Examples of gold-bearing quartz veins in granite in northeastern Ontario are Thesaurus at Matachewan, and Authier, Charest and Wisconsin-Skead near Boston Creek. Some of the Teck-Hughes ore bodies are in syenite. Other prospects in syenite are the Brookbanks, Chief and Craig at Matachewan.

Gold-Bearing Veins in Porphyry, Felsite, etc.

The most important deposits in porphyry are the lodes and fissure veins of the Kirkland Lake area, which occur in fault zones in Algoman feldspar porphyry. The Bidgood and King-Kirkland are also of this type. Near Timmins at Porcupine, practically all the gold comes from the green schist adjoining the quartz porphyry, the values in the porphyry being low or erratic. A little gold has been recovered from fissure veins in quartz-porphyry at the Little Pet, Porcupine-Porphyry Hill and Clifton-Porcupine. Gold-bearing porphyry stockworks, namely a net-work of quartz stringers in porphyry and felsite, are common in certain areas, but no deposits of this character, as yet, have been worked with success. They occur at the Champion, near Kenora, Bully Boy on Camp bay, Manitou, Boston Creek, Gold Island (Night Hawk lake), West Shiningtree, Matachewan and other places. The Ophir (Lake of the Woods) deposits are in a porphyritic

granite with phenocrysts of orthoclase half an inch wide. The acid rock at the Matachewan Gold is orthoclase porphyry. At Kirkland Lake the fine-grained, red syenite is rich in orthoclase; these rocks from the two last mentioned areas contain about 9 per cent of potash.

Depth of Mine Workings

The depth of workings of certain gold mines and prospects are as follows, the figures representing the vertical depth in feet unless otherwise stated:

Southeastern Ontario.—Deloro, 500 (incline); Cordova (Belmont), 500; Star of the East, 213.

Boston Creek and Larder Lake.—Boston Creek, 400; R.A.P., 200; Patricia (Boston-Hollinger), 215; Miller-Independence, 500; Argonaut (Huronian), 370; Harris-Maxwell (Associated Goldfields), 500; Kerr-Addison (Associated Goldfields), 300; Wisconsin-Skead, 112.

Kirkland Lake.—Kirkland Lake, 900; Teck-Hughes, 600; Orr, 400; Lake Shore, 600; Wright-Hargreaves, 600; Tough-Oakes, 500 (55° incline); Ontario-Kirkland, 450; Elliott-Kirkland, 500; Black, 155; Hunton, 100; Kirkland Combined, 200; Canadian-Kirkland, 100; Comfort-Kirkland, 150; La Belle Kirkland, 340; Fidelity, 140; Swastika, 400; Marigold (Lucky Cross), 200; Baldwin, 200; Bidgood, 400; King-Kirkland, 100; Sylvanite, 300.

Bourkes and Munro.—Bourkes, 400; Murray-Mogridge, 226; Croesus, 400 (22° incline); Burton-Munro, 318 (55° incline); Detroit-New Ontario, 183; Hill or Premier, 200; Cartwright, 100.

Porcupine.—Hollinger, 1,530; McIntyre, 1,950; Dome, 1,300; West Dome (62° incline), 350; North Dome, 325; Porcupine Crown (North Crown), 700; Vipond-North Thompson, 600; Schumacher, 600; Dome Lake, 500; Rea, 400; Davidson, 500; Foley-O'Brien, 250; Hollinger Reserve (Grey or McEnaney), 440; Hayden, 375; Anchorite, 350; Keora, 120; Clifton-Porcupine, 228 (80° incline); Plenaurum, 1,000 (drift from McIntyre); Peninsular, 180; Union, 275.

Malachewan and West Shiningtree.—Matachewan Gold Mine, 170; Thesaurus, 100; Wasapika, 200; Herrick, 150; Westree, 100; Buckingham, 105; Steep, 100; White Rock, 165.

North Shore and Michipicoten.—Long Lake, 225; Grace, 300; Shakespeare, 300.

Northwestern Ontario.—St. Anthony, 525; Saw Bill, 275; Sunbeam (A. L. 282), 43° incline, 410; Elizabeth, 280; Golden Star, 537; Foley, 420; Olive, 251; Laurentian, 480; Big Master, 285; Twentieth Century, 340; Paymaster, 325; Sakoose or Golden Whale, 165 (incline 85°); Redeemer, 235; Golden Horn or Rush Bay, 255; Regina or Black Eagle, 545; Sultana, 600; Mikado, 540; Tash-Orn, 140.

Hydro-Electric Power

The following gold mines and gold-mining areas have been or are being supplied with hydro-electric power: Porcupine, Kirkland Lake, Boston Creek, Larder Lake, Long Lake, Wawa, Canadian Homestake or Scramble, Hammond

Reef, Cordova, Deloro and Golden Fleece. The locations of the various power plants and transmission lines are shown on the accompanying maps.

Description of Gold-Mining Areas

The gold deposits of the Province, including all the producers and a number of prospects are briefly described under the areas in which they occur. The locations are shown on the accompanying maps and most of the claim numbers are given in the text. Amongst the producers, particularly in northwestern Ontario, are included many properties which have recovered a small amount of bullion from mill tests only. Owing to many of the older departmental reports being out of print it was deemed advisable to republish a number of cuts showing cross-sections through old workings, and also refer to them at greater length than some of the large present producers.

Southeastern Ontario

The Eastern Ontario gold area constitutes a narrow strip of country extending from Belmont township, Peterborough county, eastward across the counties of Hastings, Addington, and Frontenac and into the western part of Lanark, a distance of about 70 miles. It was in this area that gold was first found in the Province, in 1866, at the Richardson location. Among the most important mines were the Cordova (Belmont), Deloro, Atlas-Arsenic, and Cook. The deepest mine workings reach about 500 feet. The ores are largely of the arsenical-gold type in which the gold was recovered by various methods, namely, amalgamation, chlorination, or cyaniding. The mispickel concentrates were treated in a refinery and white arsenic was produced. The smelter at Deloro continues to operate, but since 1904, all the ores treated have been from the Cobalt silver camp. There are also quartz-pyrite gold deposits free from mispickel, such as the Cordova, Sovereign, etc.

A list of some of the important articles relating to the area is given in the foot-note below.¹

W. G. Miller, in his report on "The Eastern Ontario Gold Belt", in 1901, summarizes the geology of the area as follows:—

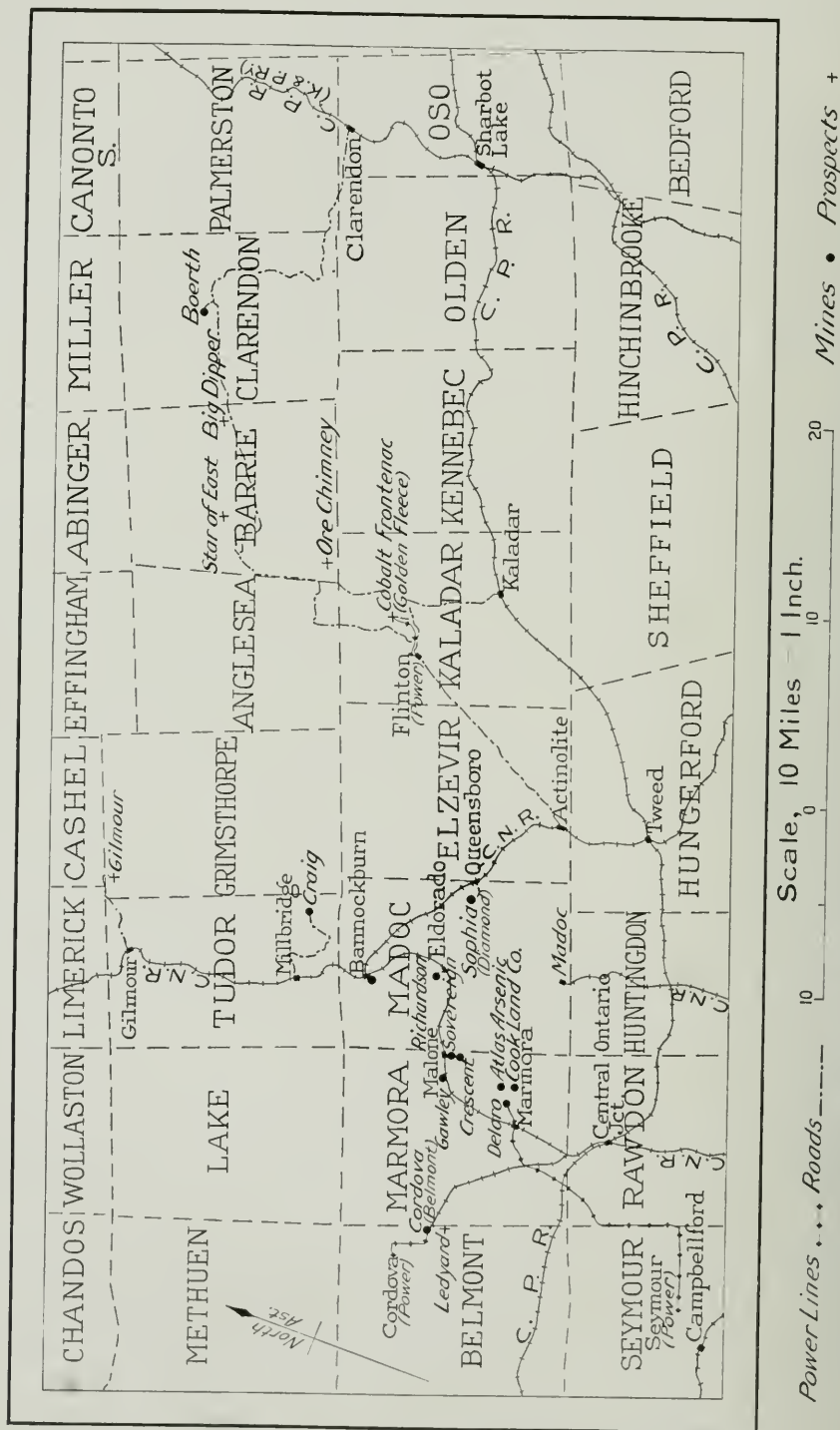
A series of diorites, crystalline limestones and various schistose rocks has been cut through by granite. . . . Overlying all the rocks mentioned are areas, here and there, of undisturbed Silurian limestone. . . . The granite was found . . . to be younger in age than either the diorite or crystalline limestone. . . . The diorite is also seen to be younger than limestone. . . . Most of the gold deposits occur near the contact of the diorite and granite, although some important ones are found at a considerable distance from the granite. . . . The cavities occupied by the deposits owe their origin to the shrinkage of the granite on cooling.²

Some years later W. G. Miller and C. W. Knight,³ made a detailed study of seven distinct key areas in the region and described more fully the relationship of the rocks in the vicinity of some of the gold mines.

¹ Can. Geol. Surv., Report 1869, etc.; Trans. Can. Min. Inst. Vol. V. pp. 233-255 "Eastern Ontario, A Region of Varied Mining Industries" by W. G. Miller; Ont. Bur. Mines, Vol. XII, 1903, pp. 108-116, "Mines of Eastern Ontario" by W. E. H. Carter; Ibid Vol. XI, 1902, pp. 101-122, "Arsenic in Ontario" by J. W. Wells; Idem, pp. 186-207, "The Eastern Gold Belt" by W. G. Miller. Vol. XXII., 1913, pt. 2, "The Pre-Cambrian of South Eastern Ontario" by W. G. Miller and C. W. Knight; also other Annual Reports Ont. Bur. Mines.

² Ont. Bur. Mines, Vol XI, 1902, pp. 186-187. The term diorite in the report cited was used in a comprehensive sense, to cover dark-colored rocks of various character.

³ Ibid, Vol. XXII, 1913, Pt. 2.



The *Cordova* (*Belmont*) mine occurs in and is genetically connected with a gabbro-diorite mass of post-Hastings age: The *Sophia* or *Diamond* mine (lots 14 and 15, concessions N. Madoc township) has visible gold, and mispickel in a quartz-calcite gangue, occurring in a Keewatin hornblende schist,¹ and near a felsite intrusion. The *Golden Fleece* or *Cobalt Frontenac* (west ½ lot 24 and lot 25, concession VI, Kaladar township) occurs at the contact of Keewatin green schist and Hastings conglomerate, the deposit consisting of schist, quartz, pyrite and gold. A production of approximately \$10,000. was obtained from a 10-stamp mill. A hydro-electric power plant at Finton now supplies the mine. The *Ore Chimney* (lots 34 to 36 in concession 1, Barrie township) is a prospect occurring on a similar contact about 5 miles northeast. The company is building a hydro-electric power plant on the Scootamatta river.

The *Deloro*, which is the best known gold mine in Eastern Ontario, and the following adjoining properties, *Atlas-Arsenic* (Lot 10, concession IX, Marmora township); *Cook* (lots 7, 8, and 9, con. IX, and lots 10, 11, and 12, con. X, Marmora township); *Sovereign* (lot 17, con. XI, Marmora township); *Gawley* (lot 18, con. IX, Marmora township), *Crescent* (lots 16 and 17, concession XI, Marmora township); and the *Richardson* mine (lot 18, con. V, Madoc township), all occur near the edge of a granite boss, Algoman in age, which intrudes Keewatin green schists and Grenville limestone. The deposits, except the *Sovereign*, consist of irregular quartz veins containing gold and mispickel, and are genetically connected with the Algoman granite.

A few other properties in the area may be mentioned; the *Gilmour*, which lies five miles east of the village of Gilmour in lot 30, con. XIX, Grimsthorpe township, was operated from 1909 to 1914, and yielded \$24,348.54 with a 5-stamp mill. The *Craig* gold mine, which is situated on the south halves of lots 4 and 5, in the third concession of the township of Tudor, has a shaft 150 feet deep on a quartz vein from 5 to 12 feet wide, and in 1905 yielded a small quantity of gold by a 6-stamp mill. The *Star of the East* (lot 24, con. X, Barrie township), also produced some gold by a 10-stamp mill in 1905. The vein consists of quartz lenses highly impregnated with pyrites occurring in crystalline limestone near diorite¹. The workings are 213 feet deep. The *Big Dipper Mining Co.* are interested in lots 4 to 21 in the tenth concession of Barrie township. Considerable work has been done on quartz veins carrying pyrite, magnetite and some gold in limestone near granite.² The *Boerth* mine, (*Clarendon Mining Co.*), which is situated in lot 28 of the seventh concession of Clarendon township, produced some gold bullion in 1899. According to W. G. Miller:³

The deposits of auriferous mispickel and quartz occur near the contact of diorite and crystalline limestone. . . . Some of the quartz veins run across the strike of the rocks. Tourmaline occurs at times mixed with the mispickel, and the ore containing this mixture is said to be the richest in gold.

Rich gold specimens came from the *Bannockburn* deposits (lot 28, con. V, Madoc township) which consists of quartz stringers and pyrite in diorite schist. Some bullion was recovered with a 10-stamp mill.

¹ Ont. Bur. Mines, Vol. XXII, 1913, Pt. 2, p. 111.

² Ibid, Vol. XV, 1906, p. 89.

³ Ibid, Vol. XI, p. 203.

The two chief properties, the Cordova and Deloro, are more fully described in the following paragraphs.

Cordova (Belmont).—(E. half lot 20, con. I, Belmont township). From its discovery in 1897 up to the end of 1903 the mine produced 16,790 ounces of gold bullion valued at \$289,302.¹ The mine lay idle from 1903 until 1911, when it was re-opened by P. Kirkegaard and worked almost continuously until the plant was burned in 1917, producing an additional amount of bullion valued at \$45,180 in gold and \$299 in silver. The total production therefore was \$334,781. Before the fire the mine was equipped with 30 stamps, Wilfley tables and a cyanide mill operated by electricity supplied from the company's own hydro-electric power at Deer lake, 2½ miles distant.

W. G. Miller and C. W. Knight, describe the deposit as follows²:—

The ore-bodies occur in a coarse-grained gabbro-diorite which invades the Grenville and Hastings series. The veins are of quartz, with which are associated iron pyrites, feldspar and calcite. The wall rock has been altered to a chlorite schist, or chlorite-mica schist, sometimes 50 feet wide, there being a gradual transition between the fresh gabbro-diorite and the schist. The latter is impregnated with quartz veinlets parallel to the schistosity. Consequently, there is not a definite boundary line between the ore and the schistose wall rock. The ore body is low-grade, the hand-culled material which is treated in the mill averaging between \$5.00 and \$6.00 per ton. The deposits may have been formed by hot solutions which followed the intrusion of the gabbro-diorite.

Speaking of the rocks in which the ore occurs they remark³:

The gabbro-diorite series is important from an economic point of view, as in it at Cordova are the auriferous veins of the Cordova mine.

The gabbro-diorite is classed as Keweenawan (?) but it may be Haileyburian or Algoman in age.

W. G. Miller also states⁴:

The large ore bodies are found at points of intersection of two fissures, and come to the surface in some cases in the form of what may be called chimneys. . . . Mispickel, which is characteristic of the Deloro and other properties farther east on the gold belt, does not occur here. Pyrrhotite, galena and copper pyrites are met with at times.

Ledyard.—Adjoining the Belmont or Cordova is the Ledyard gold mine (east half lot 19, concession 1, Belmont township), which in 1897 had a 20-ton mill and a shaft 100 feet deep.

Deloro.—The property includes lot 9, concession VIII, and adjoining lots in Marmora township, and was formerly known as the Gatling. It was operated by the *Canadian Goldfields Company, Limited*, a British concern, and has been described in the Reports of the Geological Survey and of the Bureau of Mines. Miller and Knight say⁵:

The ore bodies consist essentially of quartz lenses in the schist which contain visible gold and mispickel. The lenses conform to the strike of the schist, and cut across dikes of granite which intrude the latter. Near the surface the ore was com-

¹ Can. Min. Inst. Trans., Vol. VII, 1904, p. 120.

² Ont. Bur. Mines, Vol. XXII, 1913, Pt. 2, p. 110.

³ Idem, p. 33.

⁴ Ibid Vol, XI, 1902, pp. 190-191.

⁵ Ibid, Vol. XXII, 1913, Pt. 2, p. 110.

paratively rich, but the value gradually decreased in depth. At a depth of 500 feet in the inclined shaft, the gold represented only two or three dollars a ton, but massive mispickel was present. Two factors contributed to the closing of the mine, viz., the encountering of a heavy flow of water in the lower levels, and the discovery of rich arsenical ores at Cobalt. Deloro was the pioneer white arsenic producer in North America, but the ores now treated there all come from Cobalt.

The Deloro, at times, ran 20 stamps and had a cyanide plant for treatment of its concentrates. During the five year period of operation from 1899 to 1903, 35,877 tons of ore were raised and milled from which the total value of gold recovered was \$181,907.55, and of arsenic \$128,975.50, making a grand total value of \$310,883.05, or of \$8.66 per ton.¹ The present Deloro smelter is operated by hydro-electric power furnished by the Hydro-Electric Power Commission of Ontario from its plant at Campbellford.

Parry Sound District

McGown.—In 1894 gold-copper ore was discovered at the McGown mine, on lots 146, con. A. and B., Foley township, two miles east of the town of Parry Sound. In 1898 a 10-stamp mill was erected. According to A. P. Coleman² the deposit consists of "an irregular bedded vein about 3 feet wide containing quartz mixed with dark schistose rock and carrying some free gold and copper ores, especially bornite and chalcocite. Much of the geology corresponds to the Grenville series or Upper Laurentian of Eastern Ontario and Quebec, or to the Keewatin rocks of Western Ontario."

The McGown and neighbouring deposits were found on developing to be pockets which were more valuable for copper than for gold. Several car-loads of ore were shipped to a smelter and yielded 15.8 per cent. of copper with a little less than an ounce of silver and \$5.00 in gold to the ton.

North Shore of Lake Huron.

In this region isolated properties have yielded gold intermittently from 1892 to the present, the most important producer being the Long Lake mine. Many of the deposits belong to the Keweenawan epoch.

Crystal.—The Crystal gold mine (W.D. 44, Rathbun township), the only producer at Wanapitei lake, where gold was found in 1888, operated for a period of years following 1892. According to W. H. Collins³ the deposit consists of narrow quartz veins carrying pyrite and gold at and near the contact of Keweenawan diabase and Cobalt sediments. Mispickel, chalcopyrite and pyrrhotite are also present. A small production was obtained from a 5-stamp mill. Other prospects in the vicinity are the *Gordon, Mondour, Last Chance* and *Comstock*.

Havilah.—This mine, formerly the *Ophir*, in lot 12, in the third concession of Galbraith township, is also at the edge of a Keweenawan diabase intrusion, and is quite similar to the Crystal deposit. The vein was worked at intervals from 1892 to 1902 and was among the producers again in 1910 and 1911. During 1921 the Havilah and the Bass Lake property, 3 miles northwesterly, were taken over by *Kirk Gold Mines Company, Limited*. The Havilah mill is now being overhauled and a cyanide plant installed. According to T. L. Tanton, the Bass Lake vein is a dark quartz carrying visible gold and lying entirely in Keweenawan diabase.

¹ Jour. Can. Min. Inst. Vol. VII, 1904, p. 121, by W. E. H. Carter.

² "Copper in Parry Sound" Ont. Bur. Mines, Vol. VIII, 1899, pp. 259-262.

³ Onaping Map Area, by W. H. Collins, Memoir 95, Can. Geol. Surv. p. 12, 114.

Long Lake.—This mine¹ (W.D. 602), is situated near the southwest end of Long lake, in Timber Berth No. 69, and is reached by a 10-mile wagon road from Naughton station, 11 miles west of Sudbury. The property was purchased by the Canadian Exploration Company, Limited, who mined 150,000 tons of ore averaging about \$6.00 per ton in gold which was successfully treated by a 10-stamp mill and a cyanide plant. The bullion production from 1910 to 1916 amounted to 142,265 ounces containing \$829,281 in gold and \$262 in silver. The mine was supplied by electricity from the Wanapitei power plant. According to M. B. Baker, Timiskamian feldspathic quartzite is cut by diorite and Algoman granite, the intrusives probably being from the same magma. The diorite, which is considered to be the source of the gold, has within it a large vertical core of quartzite mineralized with fine-grained arsenopyrite, pyrite and small quantities of pyrrhotite, galena and copper pyrites. This formed the ore body, which has been cut by post-Keweenaw faults. The diorite may be Haileyburian or Algoman in age. The known ore body was mined and milled, and the faulted portion could not be found on the 225-foot level.

The *Sudbury* copper-nickel ores, of which the *Vermilion* mine in lot 6, con.

IV, Dennison township is the richest, yield some gold.²

The *Bruce* copper mines which were first worked in 1849 carry small quantities of gold in parts. The deposits occur in and are genetically connected with Keweenaw diabase.

Shakespeare.—Gold was found on lot 5, concession one, township of Shakespeare, in 1903, and work continued until the fall of 1907. During 1905, 1906 and 1907, \$38,327 in gold was recovered by a 10-stamp mill. The mine is referred to in the Ontario Bureau of Mines Reports for these years. W. E. H. Carter states that "The ore is made up of interbanded lenses and stringers of quartz and chlorite schist The contact with the granite lies to the north on the other side of the valley, probably half a mile away."³ The lode is 40 feet wide, having an ore zone on either side. Iron pyrites is the principal sulphide. A shaft with several levels has been sunk to a depth of 300 feet or more.

Howry Creek.—Gold was found here in 1911 and reported on by A. P. Coleman⁴ and W. H. Collins.⁵ The veins are found in Animikie quartzite and conglomerate and in Keweenaw diabase. According to Dr. Collins "They [the ore deposits] are chiefly well-defined quartz veins . . . composed of white quartz and ankerite carrying arsenopyrite and free gold. . . . One of the deposits [mining locations 3180-81-82, the *Bosquet*, now operated by R. R. Tough, of Haileybury] is simply a broad sheared zone in conglomerate, which has been hydrothermally altered and filled with a plexus of quartz veinlets." The *Howry Creek* main vein (S. 2279, 2782, 2783 and S. 3673), consists of altered quartzite, quartz, ankerite, arsenopyrite, pyrite, and a little chalcopyrite in quartzite near diorite. The

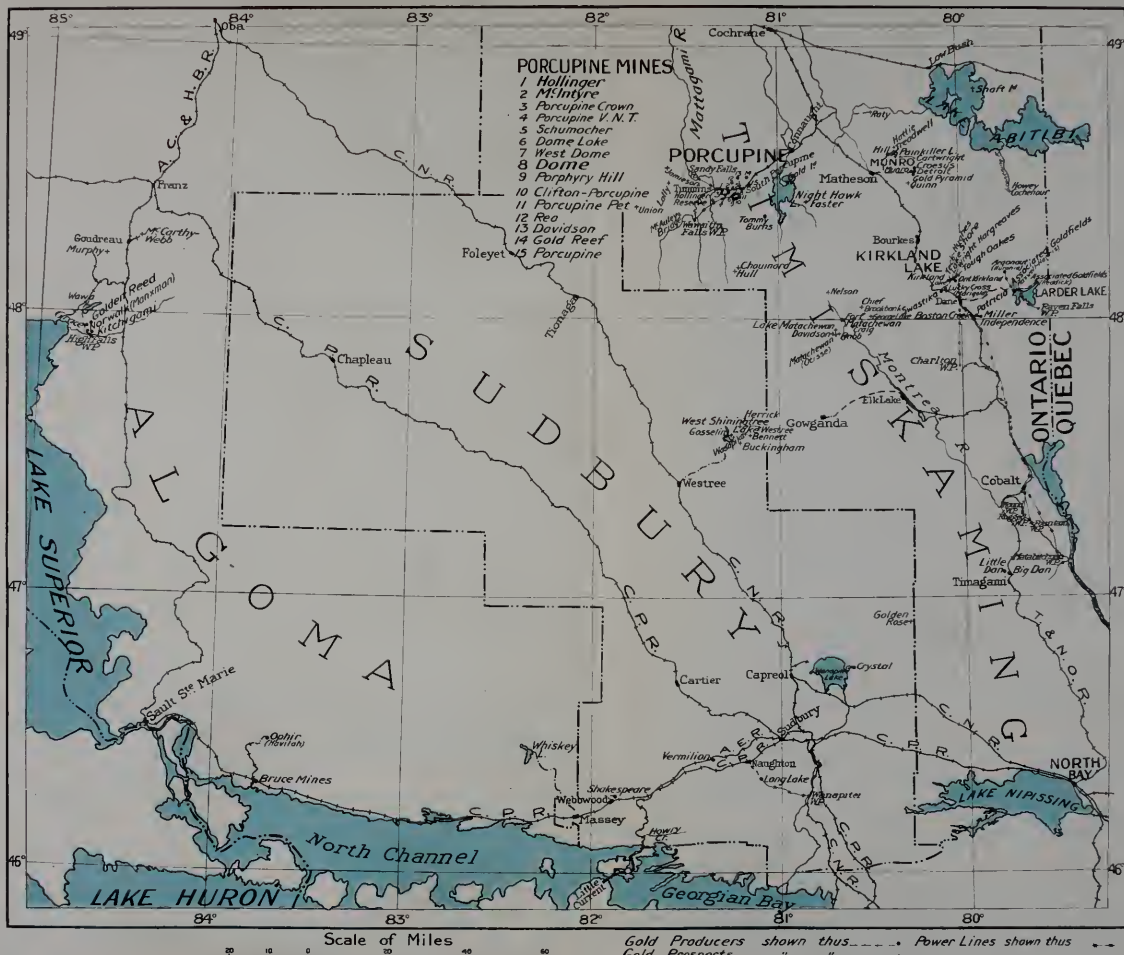
¹ Pre-Cambrian Rocks North of Lake Huron, by A. P. Coleman, Ont. Bur. Mines, Vol. XXIII, 1914, Pt. 1, pp. 202-236; Long Lake Gold Mine, by M. B. Baker, Ibid, Vol. XXVI, 1917, pp. 157-162.

² R. L. Peek, in the Feb. 1922, issue of the Bulletin of the Canadian Institute of Mining and Metallurgy, calculates from analysis of the Sudbury matte that 60,400 ounces of gold were contained in matte produced to the end of 1920. According to the Royal Ontario Nickel Commission Report, page 43, the only gold produced of any account in the Sudbury copper-nickel area came from the Vermilion mine and from the refining of the nickel-copper ores.

³ Ont. Bur. Min. Vol. XIII, 1904, pp. 70-71.

⁴ Ont. Bur. Min., Vol. XXIII, 1914, Pt. 1, p. 224.

⁵ Can. Geol. Surv. Summary Report 1917, pp. 10-13E.



Key Map of Part of Northern Ontario showing the Location of Mines that have produced Gold.

Note—Owing to the small scale of the map all prospects cannot be shown.

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Majestic Gold Mines Limited are interested in claims S. 4706, S. 4730 and S. 4731. The vein being tested in 1921 is in quartzite or arkose, and consists of quartz, white, grey, and in places almost black. Not much mineralization is visible on the surface, but occasional bunches of pyrite are encountered in sinking.

Whiskey Lake.—In 1912 gold was found on the *Wilson* claim, Whiskey Lake, which lies 30 miles by lumber road to the northwest of Massey station. According to A. P. Coleman, the gold occurs in Lower Huronian quartzite and slate near greenstone, and in a green schist near the contact of sedimentary rocks including limestone. Granite outcrops a mile north of the principal showings. "The ore as disclosed is rusty quartz containing, where not too much weathered, pyrite, pyrrhotite and a little copper pyrites and galena. Free gold could be seen at a number of places."¹

W. H. Collins,² states that the ore bodies are in Huronian (Bruce series) sediments close to intrusive bodies of diabase or in the diabase itself."

Michipicoten and Goudreau

Gold was found south of Wawa lake in 1897, and has been mined at intervals since then. Geologically coloured maps of the area by A. P. Coleman and A. B. Willmott,³ J. M. Bell,⁴ A. P. Coleman,⁵ and W. H. Collins⁶ have been published. The *Grace* (D. J. 7, or No. 1052), was the first producer in the area. Small productions also came from the *Manxman* or *Norwalk* (No. 1279) *Kitchegammi* (C B. 2, Y. 337) and *Golden Reed* (1239). According to J. B. Tyrrell the vein of the *Kitchegammi* is on the contact of a hornblende granite gneiss and an intrusive biotite granite. The mills were run by hydro-electric power supplied by the Algoma Power Company at High Falls, Michipicoten River. The deposits are lodes, containing sugary and glassy quartz carrying pyrite, pyrrhotite, chalcopyrite, arsenopyrite and visible gold with intermixed schist. They occur in Keewatin sericite schists and quartz porphyries not far from post-Keewatin granite and gneiss. The iron formation of the area carries small quantities of gold, e.g., at the *Emily*. "The location including the Helen mine itself was first staked as gold-bearing, but soon turned out to be of vastly greater importance as an iron mine."⁷

Grace, the most important mine of the area, produced during 1902, 1903, 1907, 1908 and 1910, gold bullion valued at \$71,124.

On the first level at a depth of 100 feet the ore has been stoped out for 150 feet along the vein and to the level. In the north drift on this level, 90 feet from the shaft a winze has been put through to the second level stope. At the second level 200 feet in depth, the drifts north and south are 100 feet and 180 feet in length. The north stope has been carried through to the first level, while south of the shaft stoping is being done. On the third level at a depth of 300 feet drifts have run north and south 80 feet and 50 feet respectively. No stoping has been done on this level.⁸

¹ "The Whiskey Lake Area" by A. P. Coleman, Ont. Bur. Mines, Vol. XXII, 1913, Pt. 1, p. 154.

² Can. Geol. Surv. Summary Report, 1917, pp. 8E-10E.

³ "Michipicoten Iron Ranges," Scale 2 miles to the inch, Ont. Bur. Mines, Vol. XI, 1902.

⁴ "Michipicoten Iron Ranges," Ibid, Vol. XIV, 1905.

⁵ "Iron Ranges of Southeastern Michipicoten." Ibid. Vol. XV, 1906.

⁶ "Ore Deposits of Goudreau and Magpie," Summary Report Can. Geo. Survey, 1918, Pt. E.

⁷ Ont. Bur. Mines, Vol. XV, 1906, p. 175.

⁸ Ibid, Vol. XVIII, 1909, p. 91.

McCarthy-Webb.—Gold was found on the claims (F.S.M. 2049-2052) near Goudreau in 1918. According to W. H. Collins¹ gold can be seen in quartz veinlets in narrow shear zones in an ash-grey feldspar porphyry resembling granite gneiss.

Murphy.—In April, 1921, a promising discovery of rich gold in quartz was made on the *Murphy* claims, 407 and 408, three and one half miles southwest from Goudreau. These claims are known as the *Goudreau Gold Mines*. An electrically driven 10-drill compressor is being installed. Other important discoveries have been made on the *Morrison* (2075), *Cline*, (2184, 2186 and 2189) and others.²

Gold=Mispickel Deposits near Timagami

Big Dan.—Gold-mispickel ore has been mined and shipped from the *Big Dan* and *Little Dan* properties which are situated about 2 miles north of Timagami station. The deposits have been described in various Reports of the Ontario Bureau of Mines: by A. P. Coleman³ W. G. Miller⁴ W. E. H. Carter⁵ and E. T. Corkill⁶. In 1919 C. W. Knight⁷ mapped an area in the vicinity of Cedar and Net Lakes which included these two deposits and described them in detail. According to Mr. Knight's report "The ore body (on the *Big Dan*, W.D. 271) occurs in a sheared and brecciated zone in basalt of Keewatin ageThe ore occurs in small veinlets and in grains through the rockIt consists of mispickel, iron pyrites, copper pyrites and pyrrhotiteThe shear zone . . . is gossan-stained on the surface, and has a width at the tunnel of about 50 feet and a length of about 1,000 feetThe origin . . . is uncertain⁸."

Little Dan.—This deposit on W.S. 13, W.S. 14, according to Mr. Knight, is similar in occurrence to the *Big Dan*. John E. Hardman, who was associated with the property some years ago when it was being worked, informed Mr. Knight that there were lenses of fine mispickel encountered from one to 18 inches wide. About 270 tons of mispickel were shipped and the gold and arsenic contents were paid for⁹.

Golden Rose.—Some gold was obtained from this claim on the east shore of Emerald lake during parts of 1915 and 1916¹⁰. The ore contains much copper pyrites. The deposit was discovered about 1897.¹¹

¹ Can. Geol. Surv., 1918, Pt. E.

² Ont. Dept. Mines, Goudreau Gold Area, Press Bulletin (July, 1921) by A. G. Burrows. These notes were later incorporated with Vol. XXX, Part IV.

³ Ont. Bur. Min., Vol. IX, 1900, p. 173.

⁴ Ibid, Vol. V, 1901, p. 179.

⁵ Ibid, Vol. XIV, 1905, Pt. 1, pp. 73-74.

⁶ Ibid, Vol. XV, 1906, Pt. 1, pp. 87-88; Vol. XVIII, 1909, Pt. 1, pp. 132-3.

⁷ Ibid, Vol. XXIX, 1920, Pt. 1, pp. 214-219.

⁸ Idem, pp. 214, 216.

⁹ Idem, pp. 218.

¹⁰ Ibid, Vol. XXV, 1916, p. 103.

¹¹ Ibid, Vol. X, 1901, p. 175.

Boston Creek and Skead¹

Boston Creek.—Gold has been produced at only two properties in the area, namely, the *Patricia* and the *Miller-Independence*. Both mills have been burned. The gold occurs in veins, stockworks and fahlbands in Keewatin rocks and in Algomian porphyries and granites.

The first discovery in 1914 was on the *Kenzie* vein, which extends from the *R.A.P. Company* (L. 5163) to the *Boston Creek* (L. 3665). The vein is 5 feet wide and consists of greenish quartz and some reddish calcite, with inclusions of silicified basalt and reddish porphyry carrying gold, pyrite, chalcopyrite, molybdenite and galena. The workings to the 400-foot level show that there are a few small shoots of high-grade ore, while most parts of the vein are barren. Gold, tetradymite and petzite (?) were discovered in a flat fissure quartz vein on the *Miller-Independence* (S. $\frac{1}{2}$ lot 1, concession VI, Pacaud township), in July, 1915. This vein extends easterly on to the adjacent property, *Connell-McDonough*. In 1918 an ore shoot carrying calaverite, a precious telluride, was found on the *Miller-Independence*. The calaverite occurs as veinlets in copper pyrites and quartz stringers, the deposit being roughly 160 feet in length on the dip, about 50 feet in length along the strike and 3 feet in width between two faults, in Keewatin basaltic lava, altered to calcite, ankerite, or some other carbonate. Prospecting has been carried on at the 500-foot level. The mine is run by hydro electric power.

The *Patricia* (*Boston-Hollinger*), the two north claims in lot 3 concession VI, Pacaud township, has three ore shoots of a good grade, 25, 80 and 130 feet in length and one to three feet wide. A fahlband carrying low contents of gold occurs on the *Currie prospect* (L. 5037, Boston township). At the north end of the *Boston-McRae* (N. $\frac{1}{2}$ lot 2, concession VI, Pacaud township), there are a few small quartz lenses carrying native gold, calaverite, and pyrite in altered basalt. Gold occasionally associated with a telluride occurs in veinlets in the granite on the *Authier* (L. 5025, Boston township), *Charest* (L. 5505, McElroy township), *Gold Leaf* (L. 5757, Boston township), and in a porphyry stockwork on the *Catharine Gold* (N. $\frac{1}{2}$ lot 10, concession IV, Catharine township). The *Peerless* claim, No. 5266, formerly the *Mondour*, has a 250-foot shaft on a quartz vein, certain portions of which carry considerable native bismuth, galena, cosalite and some zinc blende, pyrrhotite, pyrite, chalcopyrite and native gold in Keewatin greenstone. The *Ivanhoe* (L. 5079, Boston township), also has considerable native bismuth carrying gold. A 130-foot shaft has been sunk on the *Kennedy-Boston* (S. $\frac{1}{2}$, lot 11, concession VI, Catharine township), on a narrow fracture carrying pyrite and visible gold in places. The *Walsh-Taylor* deposit, in the N.E., $\frac{1}{4}$ of the S. $\frac{1}{2}$, lot 5, concession III, Catharine township, consists of a stockwork in rusty carbonate. The *Roger-Barnett* (N. $\frac{1}{2}$ lot 5 concession III, Catharine township), and the *Honslow* (S. $\frac{1}{2}$, lot 4, concession 1, Catharine township), are also of the stockwork type in pillow lava altering to carbonate, and carry considerable visible gold.

Skead township.—Quartz veins carrying gold, but only prospected in part, have been found in various types of rock in Skead township, namely, in granite and porphyry on the *Wisconsin-Skead* (L. 4353) and *Sampson* claim (lot 10, cor

¹ Boston Creek Gold Area, by A. G. Burrows and P. E. Hophins, Ont. Bur. Min., Vol. XXV, 1916, Pt. 1, pp. 244-259; Boston-Skead Gold Area, Ont. Dept. Mines, Vol. XXX, 1921, Pt. 6.

cession VI); in granite-porphry on the *Flanagan* claim, (lot 1, concession III); gold occurs with specular hematite, pyrite and chalcopyrite in andesite on the *Skead Gold Mines*, (N. $\frac{1}{2}$, lot 2, concession II), Telluride Synidcate (S. $\frac{1}{2}$, lot 2, concession II), and *Nigger* (M.R. 3); in porphyry on the *Manley-O'Reilly* (L.S. 128), *Lincoln-Nipissing* (C.E. 3, C.E. 4); *Zenith Gold* (Lot 1, concession VI) on the adjoining *Cook* claim (40-41) in Hearst township; and in chert on the *Fidelity*. (L. 238).

Larder Lake and Vicinity ¹

Gold was discovered at Larder Lake in 1906, and since then development has been carried on at a few properties. The total production is approximately \$50,000, mainly from the Argonaut, formerly La Mine D'Or Huronia, with a small contribution from the Harris-Maxwell and Reddick which now belong to the Associated Goldfields. The three properties are furnished with electric energy supplied from the Raven Falls power plant. Larder Lake is reached by a 17-mile wagon road from Dane station. The rocks comprise Keewatin volcanics and ferruginous carbonates and iron formation. The rusty-weathering carbonates are intersected by veinlets of quartz, which carry much of the gold of the area. Associated with the Keewatin are slate and conglomerate which are in part Timiskamian in age. Cutting the above mentioned rocks are dikes of Algoman (?) porphyry, felsite, and lamprophyre, which appear to be responsible for the gold. Lying on all these rocks are the erosion remnants of Cobalt sediments which are in turn cut by Keweenawian diabase.

Argonaut.—(L. 2587, Gauthier township), has been mapped and reported on in detail by C. W. Knight ² who states:—

There are said to be more than a score of veins, all of them containing gold, on the Argonaut property. Some of the 'veins' appear to consist mainly of felsite or feldspathic material in which occur magnetite, copper pyrites, pyrite and gold. Other veins are made up mostly of calcite, while still others consist mainly of quartz. It may be added that copper pyrites is a characteristic mineral in many of the ore bodies. Most of the veins strike northeastward and have more or less vertical dips. There has been about 1,400 feet of underground work done up to the spring of 1920.

The narrow quartz veins are in Keewatin basic schists. The total production up to the end of 1920 was approximately \$33,000. The 15-ton mill continued to operate until it was burned in the summer of 1921.

The Associated Goldfields have been carrying on development work for several years at two or three of their properties; e.g. *Harris-Maxwell* (H.S. 114, 115, Hearst township), the *Reddick* (H.J.B. 29, 30, McGarry township), *Kerr-Addison*, etc. The mineral deposits are of the stockwork type, namely, ferruginous carbonate intersected by irregular quartz and calcite veins carrying pyrite, galena, tourmaline, gold, etc. One shaft has reached a depth of 500 feet, and much diamond drilling has been done.

Gold occurs in aplite on the *Gold King*.

Katrine Township.—About 1907, gold was discovered on claims H.S. 238 and 241, which are situated in southeast *Katrine township*, 6 miles north of Larder lake. In 1919 the claims were re-staked by Geo. Tucker and optioned to the Nipissing Mining Co., who did considerable testing during the year. According

¹ Ont. Bur. Mines, Vol. XVI, 1907, pp. 202-218, by R. W. Brock; Ibid. Vol. XVII, 1908, pp. 10-11, by N. L. Bowen; Geol. Survey Can. Mem. No. 17-E, 1912, by M. E. Wilson; Ont. Bur. Mines, Vol. XXVIII, Pt. II, 1919, pp. 71-77, by P. E. Hopkins.

² Ibid. Vol. XXIX, 1920, Pt. III, pp. 65-76, by C. W. Knight.

to C. W. Knight, the gold-bearing quartz veins occur in a stock-like mass of Algoman mica syenite, porphyritic in places and cutting Keewatin basic volcanics. "These veins vary in width from a few inches to 4 or 5 feet or more . . . The veins consist mainly of quartz, and contain also iron pyrites, copper pyrites, specularite, galena and at times considerable ankerite. . . . There were no assays made which showed the absence of gold. . . . No free gold was seen in any of the veins, but gold could be obtained on panning."¹

Elstone-Dunkin.—On this property (claims L. 3894 and L. 3893, Gauthier township), 6 miles northwest of Larder Lake, gold was found in 1916. It occurs in a mineralized zone or fahlband, in altered pillow lava, 20 feet in width, which is cut by Algoman feldspar porphyry.

A section exposed in one cross trench shows from the northeast hanging-wall of greenstone 6 feet of fine-grained greenish altered rock, 4 feet of reddish porphyry greatly fractured and containing a number of quartz veinlets, one foot of fine siliceous material resembling chert with parallel bands of fine grained iron pyrites and lenses of white quartz in the direction of the schist, and seven feet of similar rock to the greenstone section just described.²

In 1921 gold was found in a narrow quartz vein in porphyry on the *Tobico* (L.9532), $\frac{3}{4}$ of a mile northeast of the Elstone-Dunkin.

Crown Reserve.—A porphyry dike 30 feet wide and carrying encouraging gold values was diamond drilled in 1921. The claim lies about a mile northeast of the Harris-Maxwell.

Kirkland Lake, Lebel, Goodfish Lake and Swastika³

Kirkland Lake is the second most important gold-producing area in Ontario. Up to the end of December, 1920, the production of gold with some silver amounted to \$4,021,473. The producing mines are situated along a fault zone $2\frac{1}{2}$ miles in length. In this zone there are irregular low to high-grade ore-shoots of various sizes. These are lode or composite vein deposits of the gold-telluride type. The fractured zone contains several faults, some of which are later than the gold, and crosses the various rocks in its path, including Timiskamian conglomerate, Algoman syenite, porphyry and lamprophyre, all the intrusions being differentiation phases from the same magma, which is believed to be the source of the gold. The ore minerals are native gold with small quantities of calaverite, kalgoorlite and hessite. Coarse calaverite has been recognised only on the Tough-Oakes, but it probably occurs finely disseminated in the adjoining deposits. The lead telluride, altaite, is common, while coloradoite and tetradyte have rarely been encountered. Other minerals present are iron pyrites, copper pyrites, molybdenite, graphite, barite, galena and zinc blende in a gangue of the enclosing rock (syenite, porphyry or conglomerate), with quartz and a little calcite. All the ore is similar in appearance and is reddish in colour, due to the included porphyry. The ore-shoots vary in width from 3 to 40 feet, and in grade from \$5.00 per ton to \$30.00 or more. The six producers will probably have a production of \$2,000,000 during 1922. The operating mines are briefly described, commencing at the west and taking them in order to the east along the main zone.

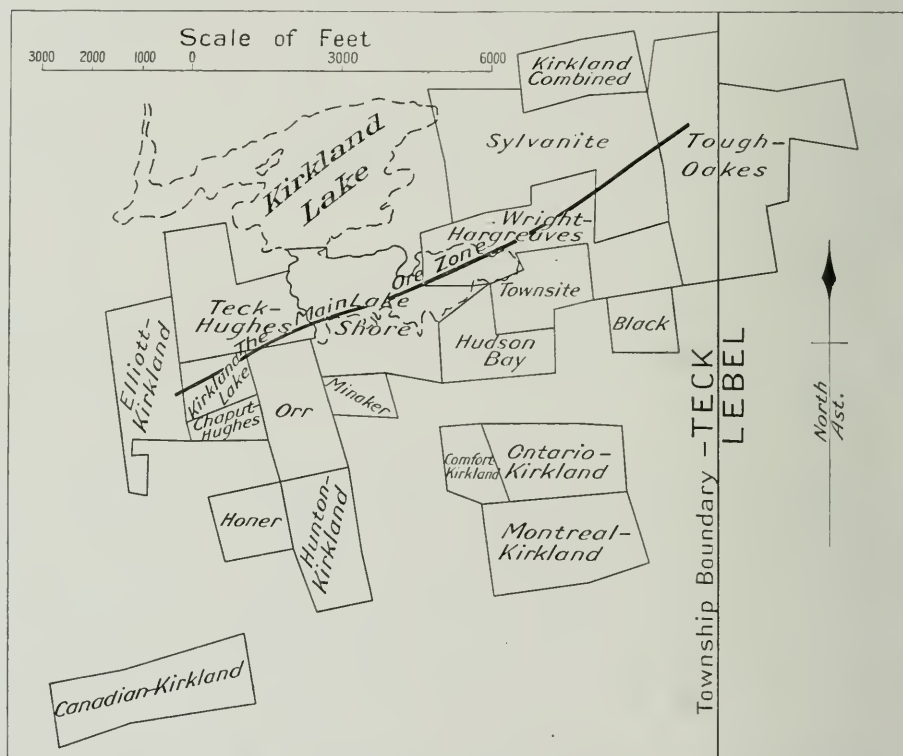
¹ Ont. Bur Mines, Vol. XXIX, 1920, Pt. 3, pp. 24-25.

² Ibid, Vol. XXVI, 1917, p. 257, by A. G. Burrows.

³ Ibid, Vol. XXIII, 1914, Pt. II, pp. 1-39; Ibid, Vol. XXIX, 1920, Pt. IV, pp. 1-48, by A. G. Burrows and P. E. Hopkins.

Kirkland Lake Mine (L. 1236) has a 140-ton mill and is milling ore from a large shoot which extends from the 250-foot to the 900-foot level, the greatest depth reached in the area. Other rich shoots have been encountered further west on the lower levels.

Teck-Hughes (L. 1238, etc.) has stoped ore up to 40 feet in width from the 600-foot level nearly to the surface. The ore is put through a 150-ton mill, the extraction being over \$9.00 per ton.

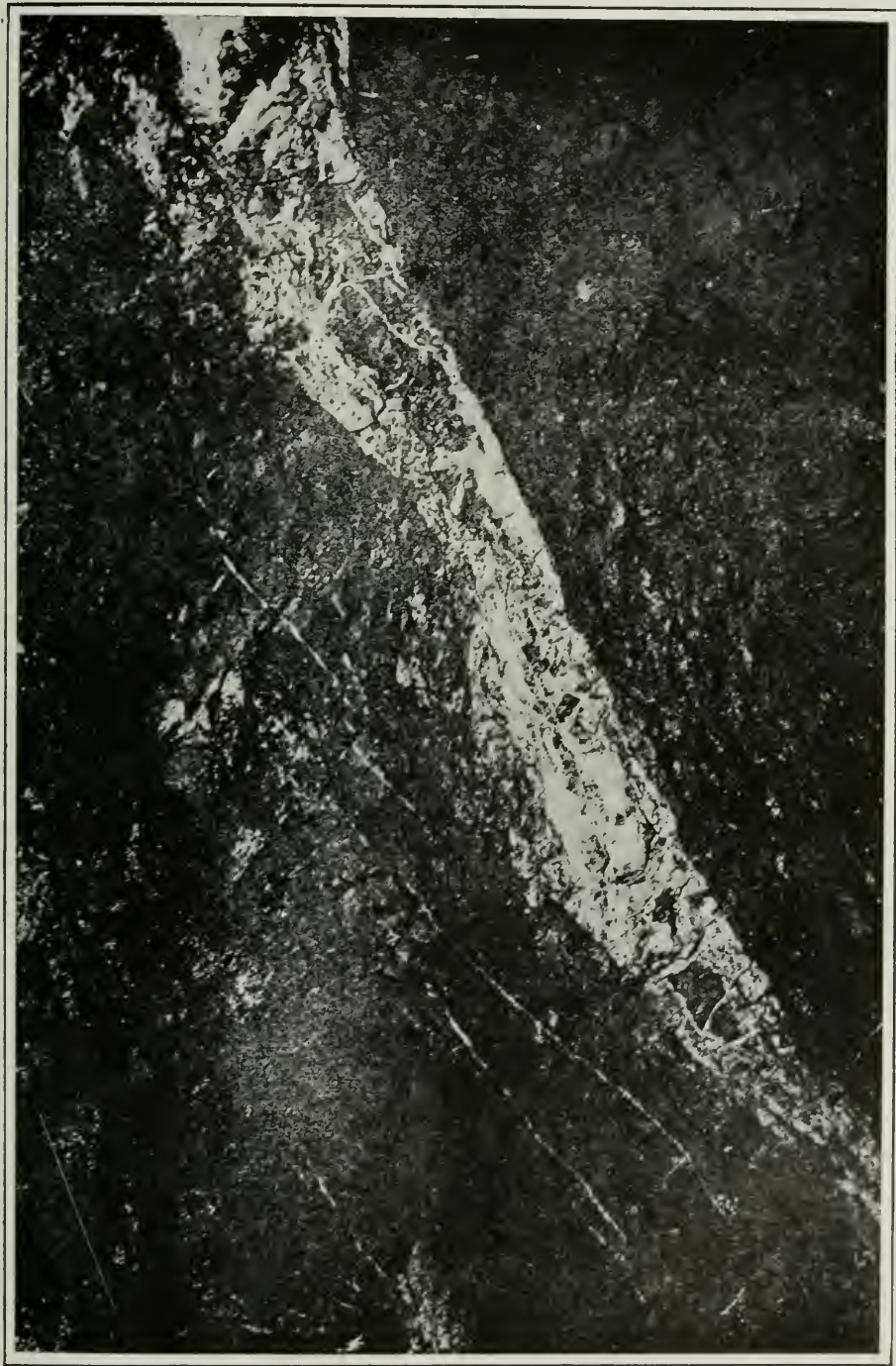


Plan showing location of several properties at Kirkland lake, in the vicinity of the main ore zone.

Lake Shore (L. 2645, L. 2605, L. 2606, L. 1557 and No. 16635) has two veins 400 feet apart with mine workings 600 feet in depth. The stopes average about 11 feet in width. During 1920 the 60-ton mill treated 19,779 tons of ore from which was recovered \$502,113 in gold and \$1,622 in silver, or at the rate of \$25.47 per ton milled.

Wright-Hargreaves (L. 2103, L. 1829, L. 1830, etc.) has deposits similar to the Lake shore opened up to a depth of 600 feet. The mill which commenced operating in May 1921 treats daily about 175 tons of ore running approximately \$12 to the ton. The vein is almost $\frac{3}{4}$ of a mile in length on the surface.

Tough-Oakes (L. 2372-L. 2376, L. 1823), with which is amalgamated the *Burnside*, was the first producer in the area. The mine yielded \$1,933,955 from



Quartz vein (No. 3) in porphyry, Tough-Oakes mine, Kirkland Lake area.
(Ont. Bur. Mines, Vol. XXIX, Pt. 4, p. 39).

three narrow parallel veins which passed from porphyry into conglomerate. The ore averaged \$20 to \$75 per ton across 5 feet. Coarse calaverite came from No. 3 vein. The mine was re-opened in 1921 and is expected to be producing again in 1922. The capacity of the mill is 125-daily.

Other prospective producers on the main zone and having apparently similar deposits are the *Orr* (T. 16626), which has developed ore on the 400-foot level, and the *Sylvanite* (L. 2100, L. 2226, etc.), which is being systematically developed at the present time to a depth of 300-feet. The *Elliott-Kirkland* on the west has a shaft sunk 500-feet on the main fracture.

About three-quarters of a mile south of the main ore zone are a number of prospects mentioned in order from west to east; *Canadian Kirkland* (L. 6729), *Honer* (L. 5433), *Hunton-Kirkland* (T. 16621), *Ontario-Kirkland* (L. 2678, L. 2679), and the *Black* (L. 2728). Of these the Ontario-Kirkland is at present the most promising. Ore of a good grade has been developed in a greywacké schist to a depth of 450-feet; a 100-ton mill has been constructed and began production in January, 1922. The *Comfort-Kirkland* is cross-cutting on L. 1329, with the hope of getting the extensions of the Ontario-Kirkland veins. On the *Kirkland Combined* (L. 6526, L. 6572,) a 200-foot shaft has been sunk on a fractured zone.

Lebel Township.¹—Deposits are being explored in Lebel township, 5 miles east of Kirkland Lake. These deposits include the *Bidgood* (L. 6796, etc.), where an ore shoot has been encountered in porphyry on the 300-foot level; the *King-Kirkland* (L. 4118, L. 8002, etc), which has drifted on a short ore shoot on the 100-foot level; and the *Lebel Oro*, which has a shaft on a narrow rich vein.

Goodfish Lake.²—At Goodfish lake, three miles north of Kirkland lake several prospects, comprising narrow lenticular quartz veins and replacement deposits, have been located along the contact of Keewatin basic volcanic rocks and schistose quartz feldspar-porphyry. The porphyry has had some influence on the gold deposition, and appears to be Keewatin or Laurentian in age. The main exploration is on *La Belle Kirkland*, claim L. 1751, where shaft A. is 340 feet deep with levels at 100, 270, and 340 feet. On the second level there are 1,100 feet of drifting and cross-cutting. Much diamond-drilling has also been done. High-grade lenses of silicified basalt up to one foot in width have been found in a zone of low grade material 7 to 10 feet in width. The *Fidelity* (L. 2845) has a 140 foot shaft on a deposit from 2 to 7 feet in width. Much work has been done on several other gold deposits, namely, *Costello* (L. 2194, L. 2202), *Martin* (L. 2233), and *Brennan* (L. 2603).

Swastika.³—Although claims were first staked for gold at Swastika as early as 1906, there was little activity until 1910, when a rich showing of gold was found on the Lucky Cross and Swastika properties. The gold occurs in shoots with pyrite

¹ Ont. Bur. Mines, Vol. XXIX, 1920, Pt. 4, 1920, pp. 46-48, by A. G. Burrows and P. E. Hopkins.

² Ont. Bur. Mines, Vol. XXIII, 1914, Pt. 2, p. 31; Ibid, Vol. XXV, 1916, Pt. 1 pp. 260-263; Ibid, Vol. XXIX, 1920, Pt. 4, pp. 20, 46, by A. G. Burrows and P. E. Hopkins

³ Ont. Bur. Mines, Vol. XXI, 1912, Pt. 2, pp. 256-265, by E. L. Bruce; Ibid, Vol. XXIII, Pt. 2, 1914, p. 20, by A. G. Burrows and P. E. Hopkins.

in lenticular quartz veins and lode deposits, 7 to 10 feet wide, in Keewatin greenstone, near the contact with Algoman red feldspar-porphyry dikes. The *Swastika* mine (R.S.C. 204, and part of lot 9, concession VI, Otto township) has a 3-compartment shaft 400 feet deep with considerable work on the 35, 100, 200, 300, and 400-foot levels. Some gold was extracted in a 10-stamp mill, the ore coming largely from two small shoots. The deposits on the *Lucky Cross* or *Marigold* (T.C. 57, 58), are of the lode type. Gold ore from the 200-foot level has been milled in the 5-stamp mill. The *Baldwin* (lot 2, concession VI, Eby township,) has a 200-foot shaft on a vein in Timiskamian conglomerate, and porphyry.

Bourkes and Seseikinika ¹

Bourkes.—Gold was found on the *Bourkes* claim, formerly the Anderson farm, (S. 1/2 lot 9, concession II, Benoit township), in 1916, and is described by A. G. Burrows² as follows:

The deposit has the character of a shear zone in which there are lenses of quartz along its strike; at one point this rusty zone is about three feet wide. Some of the quartz lenses are about a foot in width. The rocks accompanying the quartz are greatly impregnated with iron pyrites, which on the surface is very much oxidized; calcite is also abundant in the rocks. Some specimens of oxidized material showing coarse gold also contain a dark grey mineral with metallic lustre, which proved on testing to be a telluride of gold and silver with 26.88 per cent. of gold, the mineral being probably petzite.

A shaft has been sunk 400 feet and considerable work done on four levels; approximately \$20,000 of ore has been blocked out.

Gold has also been found farther east in a quartz and porphyry mass having a pegmatitic appearance, on the *Wickstead* claim, (N.W. 1/4 of the N. 1/2 of lot 4, concession I, Benoit township) and on the *Malouf* claim (N.W. 1/4 of the N. 1/2 of lot 10, concession II, Maisonville township). Gold occurs in a number of flat-lying quartz veins in Keewatin basic lava on the *Skognshi*³ (N.W. 1/4 of the N. 1/2 of lot 2, concession I, Benoit township). The *Murray-Mogridge*, formerly the Dane Copper Mining Company, has sunk a shaft 226 feet deep on a quartz and pyrite gold-bearing vein in Keewatin amygdaloidal basalt schist on lot 5, concession V, Maisonville township. On the same lot gold occurs in quartz veinlets in Algoman feldspar-porphyry. Narrow quartz veins carrying native gold and telluride of gold and silver were found in 1914, on the *Labine-Smith* claims on lot 9, concession II, Maisonville township. Quartz veins containing gold and tellurides also occur on the *Stitt* claims in central Grenfell township. The *Golden Summit* or *Seseikinika* property (lot 6, concession I, Maisonville township), was discovered in September, 1916. A 20-foot pit has been sunk on a 6-inch quartz vein carrying pyrite and some native gold in Keewatin basalt.

¹ Maisonville, Grenfell and Eby, Ont. Bur. Mines, Vol. XXIII, 1914, Pt. 2, pp. 33-35, by A. G. Burrows and P. E. Hopkins; Gold-bearing Veins in Benoit Township, Ibid, Vol. XXVI, 1917, pp. 248-251, by A. G. Burrows.

² Ibid, p. 250.

³ Ont. Bur. Min., Vol. XXVI, 1917, p. 281.

Munro Township and Vicinity ¹

Prospecting has been going on in and around the southwest corner of Munro township since 1908, when gold was first found in the area. A 9-mile wagon road connects the area with Matheson station. The early mining was on narrow quartz veins, carrying gold, pyrite, galena and molybdenite in Timiskamian sediments occasionally cut by Algonian porphyry. Small production came from the *Detroit-New Ontario* (southwest quarter, south half, lot 10, Concession I, Munro township), *Gold Pyramid*, (part of lot 11, concession VI, Guibord township), and the *Munro* or *Guelph* in the south-east corner of lot 11, concession I, Munro township. In 1918, gold accompanied by pyrite, copper pyrites, pyrrhotite and galena was found on the *Quinn* veteran lot (north half of lot 1, concession IV, Hislop township), in a narrow quartz vein cutting porphyry or rhyolite and basalt. The most important deposit was the *Croesus* (north half, lot 10, concession I, Munro township), which was discovered in 1914, and up to the time operations ceased in February, 1918, had produced 12,470 ounces or \$259,953 in gold in a 50-ton Hardinge ball mill with amalgamation plates. The ore was probably the richest ever mined in Ontario; large pieces of milky white quartz contained over 20 per cent gold by weight. A shaft was sunk 400 feet in depth, with levels at each 100 feet, on a lenticular quartz vein dipping 22° east in Keewatin greenstone. The vein cuts across alternating flows of Keewatin basalt and diabase. Other properties in the area are the *American Eagle* and *Burton-Munro*. During 1921, Messrs. Barlow and Falkenham of Matheson, discovered a spectacular gold showing on the claim directly north of the *Croesus*.

Painkiller Lake ²

In 1907, gold was found at Painkiller lake, which lies 10 miles by wagon road from Matheson. The majority of the deposits are small fissure veins of the gold-telluride-quartz type carrying gold, bismuth, telluride, pyrite, chalcopyrite, pyrrhotite, galena, zinc blende, quartz, chlorite, sericite and calcite. Another type of vein containing much mispickel, pyrite and quartz and carrying low contents of gold, silver, and copper, can be seen on the *Mayot* (lot 9, concession VI, Beatty township), and *Dunlop* (in lot 8, concession V, Beatty township). These deposits resemble the gold mispickel bodies at Timagami. The rocks are Keewatin pillow lavas intruded by Algonian porphyries, which bear some relation to the origin of the deposits. The *Hill* in lot 11, concession V, Beatty township, put a trial sample through its 50-ton Hardinge ball mill which yielded gold valued at \$635. The property is now operated by the *Premier Gold Mining and Exploration Company*. The *Hattie* (lots 6 and 7, concession I, Coulson township), encountered some rich showings during shaft-sinking in 1921. *Cartwright* and *La Santa Lucia* have been united under one company called *Blue Quartz Gold Mines Limited*; some diamond drilling was done in 1921. Other properties in Beatty township are the *McMaster* (in lot 9, concession V), and *Painkiller* (lot 7, concession VI).

¹ Geological Map No. 21c Munro and Guibord by A. G. Burrows, Ont. Bur. Mines, Vol. XXI, 1912; Beatty-Munro Gold Area, by P. E. Hopkins, Ibid, Vol. XXIV, 1915, pp. 171-184; Abitibi-Night Hawk Gold Area, by C. W. Knight, A. G. Burrows, P. E. Hopkins and A. L. Parsons, Vol. XXVIII, Pt. 2, 1919, pp. 53-56.

² Beatty-Munro Gold Area, by P. E. Hopkins, Ont. Bur. Mines, Vol. XXIV, 1915, pp. 171-184; Abitibi-Night Hawk Gold Area, by C. W. Knight, A. G. Burrows, P. E. Hopkins and A. L. Parsons, Ibid, Vol. XXVIII, 1919, Pt. 2, pp. 56-61.

Rickard Township ¹

In July, 1917, gold was found on the *Raly* claim in the southwest quarter of the south half of lot 7, concession IV, Rickard township. During the following year considerable work, namely, 2,000 feet of diamond drilling and 700 feet of drifting on the 100-foot level, was done, which showed only one small shoot of ore, 39 feet in depth. Pyrite, chalcopyrite, galena, and molybdenite occur in all parts of the quartz vein while coarse gold, bismuth and tellurides occurred in the small ore shoot. The rock consists of Keewatin basalt with subordinate amounts of banded chert, which are intruded by Algoman feldspar porphyry. The wall rocks adjacent to the vein are replaced by calcite. ..

Lightning River ²

In August, 1917, gold was found on the *Howey-Cochenour* claim L. 7315, in Holloway township. According to A. G. Burrows, and C. W. Knight, the rocks comprise alternating flows of Keewatin basalt and rhyolite lying in a nearly vertical position. The rhyolite in many parts of the area shows the presence of gold in small quantities. The original discovery is a sheeted zone from 2 to 3 feet wide, in which is a persistent quartz vein up to 10 or 12 inches wide containing calcite, chlorite, feldspar, pyrite, zinc blende, galena and visible gold. A 70-foot incline shaft was put down on the vein, but values lowered considerably when the vein passed from the more basic rock into rhyolite. Other important discoveries were made in the area during 1921.

Abitibi Lake

In 1906, there was a rush to this area, and a large number of claims were staked along the shore of the lake and on the islands. Several gold-bearing veins were found in the Keewatin schist and dolomite, Haileyburian (?) diabase and Algoman (?) granite and porphyries. These have been described by W. G. Miller³, M. B. Baker⁴ and others⁵. None of the deposits appear to be of economic value. The principal showing, that on *Shaft* or *Gold Island*, is a narrow quartz vein carrying iron and copper pyrites and zinc blende in a diabase which is regarded by A. G. Burrows, and C. W. Knight, as pre-Algoman (Haileyburian?) in age.

Patten River ⁶

North of Lake Abitibi narrow auriferous veins occur in an altered quartz gabbro (Haileyburian?) near the mouth of the Patten (Woman) river and two miles west of mileage CXXV, interprovincial boundary between Ontario and Quebec.

¹ Ont. Bur. Mines, Vol. XXVII, 1918, pp. 212-214; Ibid, Vol. XXVIII, Pt. 2, 1919, pp. 61-62; Can. Min. Journal, February 15th, 1918, p. 57.

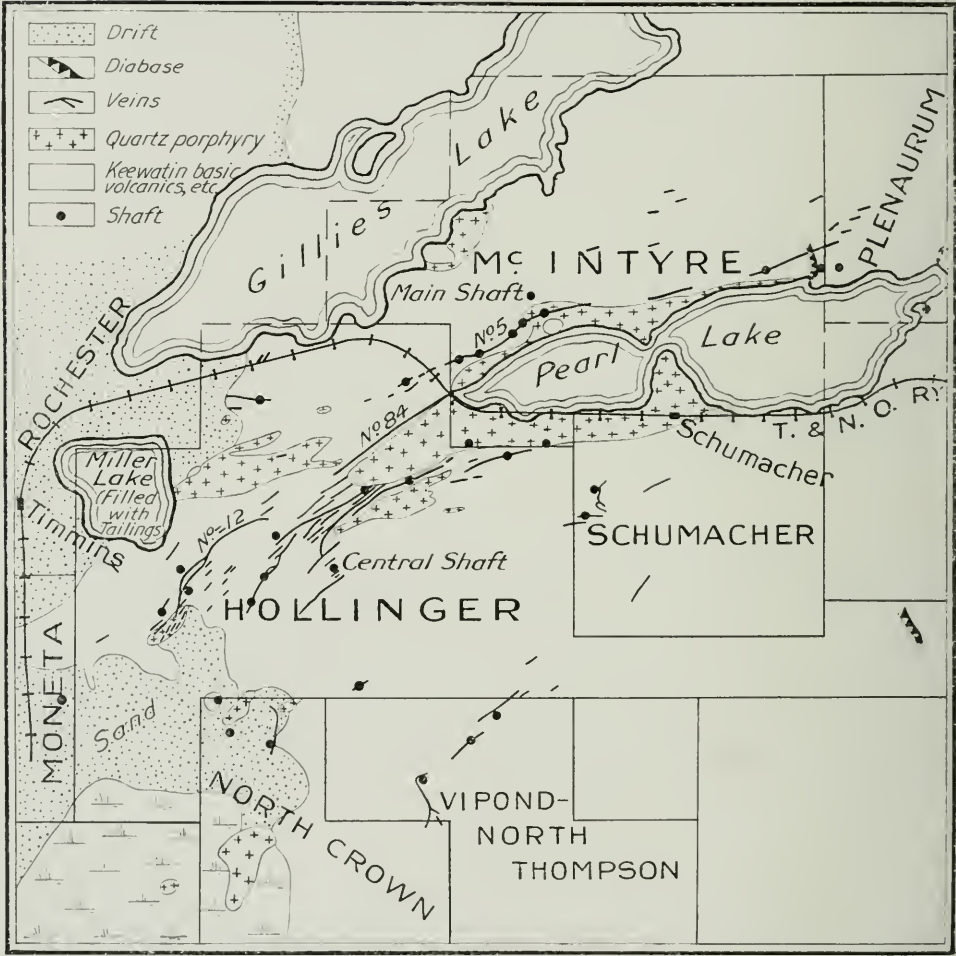
² Abitibi-Night Hawk Gold Area, Ont. Bur. Mines, Vol. XXVIII, 1919, Pt. 2.

³ Ont. Bur. Mines, Vol. XVI, 1907, Pt. 1, 219-220.

⁴ Ibid, Vol. XVIII, 1909, pp. 263-283.

⁵ Ibid, Vol. XXVII, p. 209; Vol. XXVIII, Pt. 2, p. 52.

⁶ Ont. Bur. Mines, Vol. XXVII, Pt. 1, 1918, pp. 209-210, by P. E. Hopkins.



HOLLINGER-McINTYRE GOLD AREA

Scale of Feet
2000 1000 0 2000 4000

Porcupine and Vicinity ¹

This is by far the most important gold area in Ontario. The first reported gold discovery was made in 1908, in quartz and schist on the *Hunter* claim on the east side of Porcupine lake. The discovery that caused a rush to the area was made by J. S. Wilson, in 1909, on the claim that came to be known as the *Dome* mine. During the following two years several mills were erected and production began. Up to the end of 1920, the total production from Porcupine was valued at \$64,737,349. During 1920, the output was \$10,597,572; in 1921, it was \$13,095,630 in gold and \$73,671 in silver. The three principal mines are the Hollinger Consolidated and McIntyre-Porcupine near the town of Timmins, and the Dome, three miles to the south-east. The ore deposits occur in Keewatin basic volcanic schists in the Hollinger area, and in the Keewatin volcanics and Timiskamian greywacke-conglomerate at the Dome; in both cases they are near the contact of schistose quartz porphyry which is classified as pre-Algonian in age. According to A. G. Burrows, the Ontario Department of Mines' geologist who studied the ore deposits, the intrusions of quartz porphyry in different parts of Tisdale township, have in some way influenced the deposition or location of the gold, but it is not likely that the porphyry has been the source of the gold-bearing solutions. ² W. G. Miller, regards the quartz veins as genetically related to the Algonian granites and associated rocks of the region ³.

The ore deposits are of large size, low to medium in grade, and of the lode type in structure, containing much mineralized schist, metasomatically replaced. Iron pyrites is the most abundant sulphide, copper pyrites, galena and zinc blende usually occurring in the richer parts. Pyrrhotite is quite common at the Dome. Other minerals associated with the schist and quartz gangue are calcite, dolomite, scheelite, tourmaline, graphite, feldspar, chlorite, sericite, etc. The value of the ore has not decreased in depth. Number 5 vein on the McIntyre has an ore shoot 1,500 feet in length; the same ore shoot continues for at least 100 feet on Hollinger ground. No. 1 vein on the Hollinger averages 10 feet wide in ore for a length of 1,000 feet. The No. 84 ore zone on the Hollinger is 900 feet long with a lean place in the centre. Many shoots are 500 feet in length. Much thrust faulting has been encountered, e.g., in the upper levels of the McIntyre No. 5 vein, and on the Porcupine Crown vein.

Following are brief descriptions of the ore deposits and of the various types of gold occurrences: these are partly summarized from Mr. Burrows' reports. Reference should be made to the maps accompanying these reports for the geology and locations of the several deposits. Many unimportant gold discoveries have been made in almost every township in the vicinity, but these are too numerous to enumerate; however, the several types will be mentioned. Production figures for the mines mentioned hereunder are complete up to the end of 1921.⁴

Hollinger.—The Hollinger Consolidated, the greatest gold mine in Canada, comprises 400 acres in the vicinity of the town of Timmins in Tisdale township. All the rocks are schistose, consisting of Keewatin ellipsoidal basalt and dacite intruded by wedge-shaped, chonolithic masses of quartz porphyry. The apex of the main, canoe-shaped mass of quartz porphyry around which the ore bodies

¹ Porcupine Gold Area, by A. G. Burrows, Ont. Bur. Mines, Vol. XX, Pt. 2, 1911, pp. 1-39; *Ibid.*, Vol. XXI, 1912, Pt. 1, pp. 205-249; *Ibid.*, Vol. XXIV, 1915, Pt. 3, 1-57.

² *Ibid.*, Vol. XXIV, 1915, Pt. 3, p. 25.

³ *Ibid.*, Vol. XX, 1911, notes accompanying map.

⁴ Values do not include the exchange premium.

occur recedes or dips about 50° to the northeast. In the grey schist surrounding the quartz porphyry mass, are numerous, large, closely-spaced parallel veins or lodes consisting of quartz and mineralized grey schist. Some of the veins extend into the porphyry, but the gold values in the veins in the porphyry are either low or erratic. The veins cut the schist at a low angle and appear as overlapping lenses, many of which are connected by branch veins forming, on the whole, large lode deposits. The southerly veins dip 87° to the southeast, while the big No. 84 vein on the north side of the porphyry dips 85° to the northwest.

Underground workings total 40 to 45 miles, the deepest level being 1,530 feet. In 1920, sinking, drifting, cross-cutting and raising amounted to 18,103 feet. An electric haulage system is used on the main levels underground.



No. 4 vein on 425-foot level, Hollinger Mine, Porcupine, showing the lode structure. (Ont. Bur. Mines, Vol. XXIV, Pt. 3, p. 38).

During the latter part of 1921 the mill treated approximately 3,900 tons of \$8.00 ore daily. The total production and dividends paid to the end of 1921, were \$41,193,925 and \$16,558,000 respectively. In the annual report of the Hollinger for the year ending December 31st, 1921, the developed ore is given as 3,402,609 tons, valued at \$36,644,154. During 1922 the management hopes to attain a largely increased production from a lower grade of ore.

McIntyre.—The main quartz porphyry mass and veins Nos. 64, 84 and 91, of the Hollinger extend northeasterly on to the *McIntyre* (which has taken over the *Pearl Lake* and *Jupiter* mines); these vein extensions on the latter property are known as Nos. 1, 7, and 5 respectively. The No. 5 fissure vein, which dips highly to the northwest, has an extremely long ore shoot (1,500 feet), which rakes

steeply to the northeast. Much graphite is present in parts of the deposit. Vein No. 7, which lies a short distance south of No. 5, has been opened up for a considerable length on the lower levels. Vein No. 1, on the south side of the porphyry, was also an important deposit. Owing to the porphyry mass being somewhat wedge-shaped, more green schists and additional ore bodies are being encountered on the lower levels. In all about 63,000 feet of work has been done. The mill treats about 600 tons of \$11.00 ore per day. It is the intention to enlarge the mill to a capacity of 800 tons daily. The total production to the end of 1921, was \$11,857,382 in gold and \$104,197 in silver. Dividends paid up to the end of 1921, amounted to \$2,540,698. Developed ore reserves are valued at approximately 5½ million dollars.

Dome.—The Dome Mines, with which is incorporated the Dome Extension, comprise 400 acres in Tisdale township lying three miles southeast of the Hollinger and McIntyre. The ore bodies are less regular than the Hollinger, occurring in Keewatin basalt and the Timiskamian greywacké, and largely on the northerly edge of a schistose quartz porphyry mass. Some ore comprises well mineralized schist with numerous rich quartz veinlets. The veins strike a little north of east and dip nearly vertically, forming a large low grade, egg-shaped deposit, pitching about 45° towards the Dome Extension. Large low grade deposits have been worked by means of an open pit some 250 feet in width, and 930 feet in length. Recently, smaller individual higher-grade lodes are being worked; these are 10 to 40 feet or more in width, and yielding a higher grade of ore. Pyrite, pyrrhotite and galena are the chief sulphides. Recently some tellurides have been encountered. Ore of a good grade has been developed on the deepest levels, namely, 1,300 feet. Electric motors with storage batteries are in operation on the main levels. The mill has recently been treating about 1,000 tons of \$7.00 ore daily. Sufficient ore is blocked out to keep the mill running at a maximum capacity for three or four years.¹ The total production, 1912 to 1921, inclusive, has been \$13,821,613 in gold and \$13,919 in silver. Dividends paid to the end of 1921 were \$2,391,412.

Porcupine Crown.—This mine to the end of 1920, has produced \$2,863,873 from a 4 to 7-foot quartz vein which strikes north and south and dips steeply to the east on or near a porphyry-basalt contact. The property together with the two *Thompson-Krist* claims is now owned by the *North Crown* company.

Vipond North Thompson.—The veins in this mine occur in altered greenstone and have been worked to a depth of 600 feet. The production of gold and silver amounted to \$808,204, largely from the *Vipond* portion.

Schumacher.—This mine from 1915 to 1918, milled 112,124 tons of ore, yielding \$561,885.02 in gold, and 4,194 ounces of silver from narrow contorted, low grade veins in highly altered Keewatin schists.

Rea, or Newray, also produced a small amount, namely, \$147,076, from a rich ore shoot, approximately 200 feet long, 200 feet deep and 4 feet wide.

Plenaurum, Rochester and Moneta are promising prospects in this area. During 1921 the Nipissing Mining Co., did considerable diamond drilling on the Rochester.

Dome Lake.—Small isolated ore shoots, 2 and 3 feet in width, occur on this property in an east-west shear zone or fahleband, 1,000 feet in length. The ore consists of quartz, calcite, pyrite and metasomatically replaced rock, namely, amygdala-

¹ Dome Mines Company annual report for the year ending Mar. 31st, 1920.

loidal and ellipsoidal green lava. The vein has been worked to a depth of 500 feet where the deposit dips north on to the West Dome. The property which is now closed, from 1915 to 1920 inclusive, produced gold worth \$320,391 and silver valued at \$1,435. These shear zones continue westerly on to the *Dobie*, or *Porcupine Tisdale*, where some favourable assays have been obtained from the surface.

West Dome and Apex to the west of the Dome have an ankerite vein some 20 feet in width cut by quartz veinlets which carry gold.

Porcupine Pet, (H.R. 907), *Preston*, or *Clifton-Porcupine* (H.R. 826), and *Porcupine-Porphry Hill* (L.O. 325), in Deloro township, have each produced a small quantity of gold from narrow quartz veins in a rather massive quartz porphyry. A little visible gold occurs in quartz veinlets in Timiskamian conglomerate on the *North Dome*.

In the north part of the area there are large east-west shear zones in Keewatin greenstone. These are impregnated with secondary carbonate, quartz, and pyrite, and contain large lenses of quartz up to several feet in width. The *Davidson* is the only one in the area of this type which has made any production, the amount to the end of 1920 being \$53,914. Other similar deposits in the zone are the *Beaumont*, formerly called *North Davidson*, *Crown-Chartered*, *Armstrong-McGibbon*, *Bannerman*, *Scottish-Ontario*, *Mulholland* and *Hughes*. Adjoining the *Hughes* is the *Gold Reef*, which produced a small amount of gold from narrow rich veinlets in basalt. Further east are the *Keora*, with gold in rusty carbonate, and the *Three Nations* and *La Palme* with narrow gold-bearing quartz veins in Timiskamian conglomerate.

Gold-bearing quartz veins also occur in Timiskamian sediments on the *McAuley-Bridge* claims in Bristol township. In the same township in 1921, gold was found in a narrow quartz vein in basalt schist on the *Hendrickson* claim. There are auriferous quartz veins in dolomite or ankerite on the *Anchorite* and *Maidens-McDonald* in Deloro township, and on the *Foster* claim in Thomas township. On the *Anchorite* a shaft has been sunk 350 feet and some ore of a good grade developed in two veins. Banded iron formation is cut by secondary gold-bearing quartz veins on the *Wright* (R.S.C. 175, R.S.C. 176), *James* and *Philadelphia* claims in Deloro township. Gold occurs in quartz veinlets in red aplite (large low-grade stockwork deposits), on *Gold Island*,¹ *Night Hawk Lake*, and in the adjoining Keewatin green schist. Rich ore was encountered in green schist in the 180-ft. shaft and on the 80-ft. level of the *Peninsular*, *Night Hawk lake*.

The *Tommy Burns* or *Triplex* in the southeast part of Shaw township has produced a few hundred dollars in gold. The small quartz vein on this property contains visible gold and occurs in pillow basalt, iron formation and an intrusive porphyry. Considerable development work has also been done on the *Triumph*, *Success*, *Hollinger Reserve*, *Whelpdale*, *Hayden*, *Big Dyke*, *Porcupine Paymaster* (formerly *Standard*), *March*, *Hollyrex* and others.

Gold has been found in several places west of Porcupine in Keewatin rocks. At Kamiskotia lake², in Robb township, are masses of Haileyburian (?) gabbro and diabase which have acid phases represented by felsite and aplite. The

¹ Ont. Bur. Mines, Vol. XXIV, 1915, Pt. 3, p. 27.

² Idem, pp. 58-60. Kamiskotia Lake Area, by A. G. Burrows and P. E. Hopkins.

principal deposit, the *Jamieson*, three-quarters of a mile south of the lake, consists of one of these felsite dikes intersected by gold-bearing quartz veinlets and carrying iron and copper pyrites, tourmaline and calcite. The *Lally* prospect is situated about three miles from the north boundary, on the east line of Turnbull township. Two shallow shafts have been sunk on a stockwork of porphyry and quartz.

At *Cripple Creek*,¹ in Carscallen and Denton townships, gold occurs with iron pyrites in lenticular quartz veins and parallel stringers in Keewatin schist and Algoman gray granites. At the *Union* mine, Whitesides township, a 275 foot shaft has been sunk on a quartz-schist zone, 40 feet in width. Gold occurs near the south boundary of McArthur township,² in a network of veinlets in a quartz feldspar dike on the *Chouinard* claim and in a narrow quartz vein in felsite on the *Hull* claim.

Matachewan³

At Matachewan gold is found in narrow quartz veins in a boss of red Algoman syenite on the *Brookbank* claim (17801, Alma township), and on the *Chief* claim (17310 Alma township). A stockwork deposit, 150 feet in width occurs in the same syenite mass on the *Craig* claims (16227 and 16228, Cairo township). A 100-foot shaft has been sunk on a small vein occurring in the hornblende and mica granite on the *Thesaurus* (M.R. 5868, Baden township). The principal deposits in the area are on the *Davidson* (5372 and 5373), and *Matachewan Gold Mines*, (5379, 5380, formerly the *Otisse*), in Powell township. On the Davidson, according to Mr. Burrows' second report,⁴ "most work was done on irregular masses of quartz in a rusty weathering greenish schist. Considerable surface work was also done on a red syenite or orthoclase porphyry intrusive, which is intersected by quartz veinlets in a more or less stockwork arrangement, with many of the veinlets roughly parallel. Some very good assays were obtained in parts of the porphyry intrusive, but no underground work has been done as yet on these claims." On the Matachewan Gold Mines, "A number of separate ore shoots were indicated by this means [trenching]. In addition to trenching, further prospecting was done by means of diamond-drilling, after which two shafts were sunk. No. 1 shaft was sunk to a depth of 170 feet vertically, and drifts were run on the 160-foot level along a mineralized contact, between the basaltic rocks and the light green calcareous rocks. . . . Several varieties of ore have been recognized in the workings. The most prominent is a light grey rock that has been altered from a dark basaltic rock. This carries abundant iron pyrites of small grain, much carbonate of iron, lime and magnesia; secondary feldspar, some sericite, and quartz in minute veinlets. Several narrow dikes or irregular masses of red

¹ Cripple Creek Gold Area, by W. R. Rogers and E. L. Bruce; Ont. Bur. Mines. Vol. XXI, 1912, Pt. 1, pp. 266-270.

² Notes on McArthur Township, by P. E. Hopkins, Idem, pp. 278-280.

³ The Matachewan Gold Area, by A. G. Burrows, Ont. Bur. Mines. Vol. XXVII, 1918, Pt. 1, pp. 215-240; Ibid. Vol. XXIX, Pt. 3, 1920, pp. 53-64; Mem. No. 115 Geol. Surv. Canada, 1919, by H. C. Cook; Origin of the Gold Deposits of Matachewan, Econ. Geol. Vol. XIV, No. 4, 1919, by H. C. Cook. Geological maps accompany these reports.

⁴ Ont. Bur. Min., Vol. XXIX, 1920, Pt. 3, pp. 57, 59, 60, 61.

or grey porphyry occur in trenches to the west of No. 1 shaft. They intrude the light-greenish carbonate schist, and these, particularly the grey varieties, frequently carry high gold values. They are so irregular that it is impossible to connect outcrops revealed in trenches only twenty feet apart. The schist along the porphyry intrusion usually carries gold values, where there are quartz stringers and an impregnation with iron pyrites." Iron pyrites, copper pyrites, and scheelite are present in the ore.

Gold has been found on the *Robb* claim (5402) and *Lake Matachewan Gold Mines* (5531 and 5514), in Powell township. During the fall of 1921, gold bearing quartz in porphyry was discovered in a small Keewatin area in the vicinity of George lake in Holmes and Flavelle townships. In 1921, B. Mickmac, an Indian, discovered a spectacular gold showing in conglomerate (?) schist in the north central part of Rankin township.



Gold-bearing quartz veinlets in syenite porphyry on the Davidson property, Matachewan area. (Ont. Bur. Mines, Vol. XXIX, Pt. 3, p. 56).

A hydro-electric development at Indian Chute on the Montreal river is projected to serve the power needs of this area.

West Shiningtree ¹

Since the first discovery of gold in 1911, when the railway was 60 miles distant, numerous other finds have been made in parts of four townships. The railway now passes within 20 miles, and is connected by a wagon road with most of the properties. No gold has yet been produced apart from what may have come from a few high-grade samples. The encouraging results obtained on a few properties, e.g., the *Wasapika*, *Herrick*, *Buckingham*, and *Gosselin*, may lead to min-

¹ West Shiningtree Gold District, by R. B. Stewart, Ont. Bur. Mines, Vol. XXI, 1912, Pt. 1, pp. 271-276; West Shiningtree Gold District, Ibid, Vol. XXII, 1912, pp. 233-237; West Shiningtree Gold Area, by P. E. Hopkins, Vol. XXIX, 1920, Pt. 3, pp. 28-52; Mem. No. 95, Onaping Map-Area between Shiningtree and Onaping Lakes, Geol. Sur. Can., by W. H. Collins.

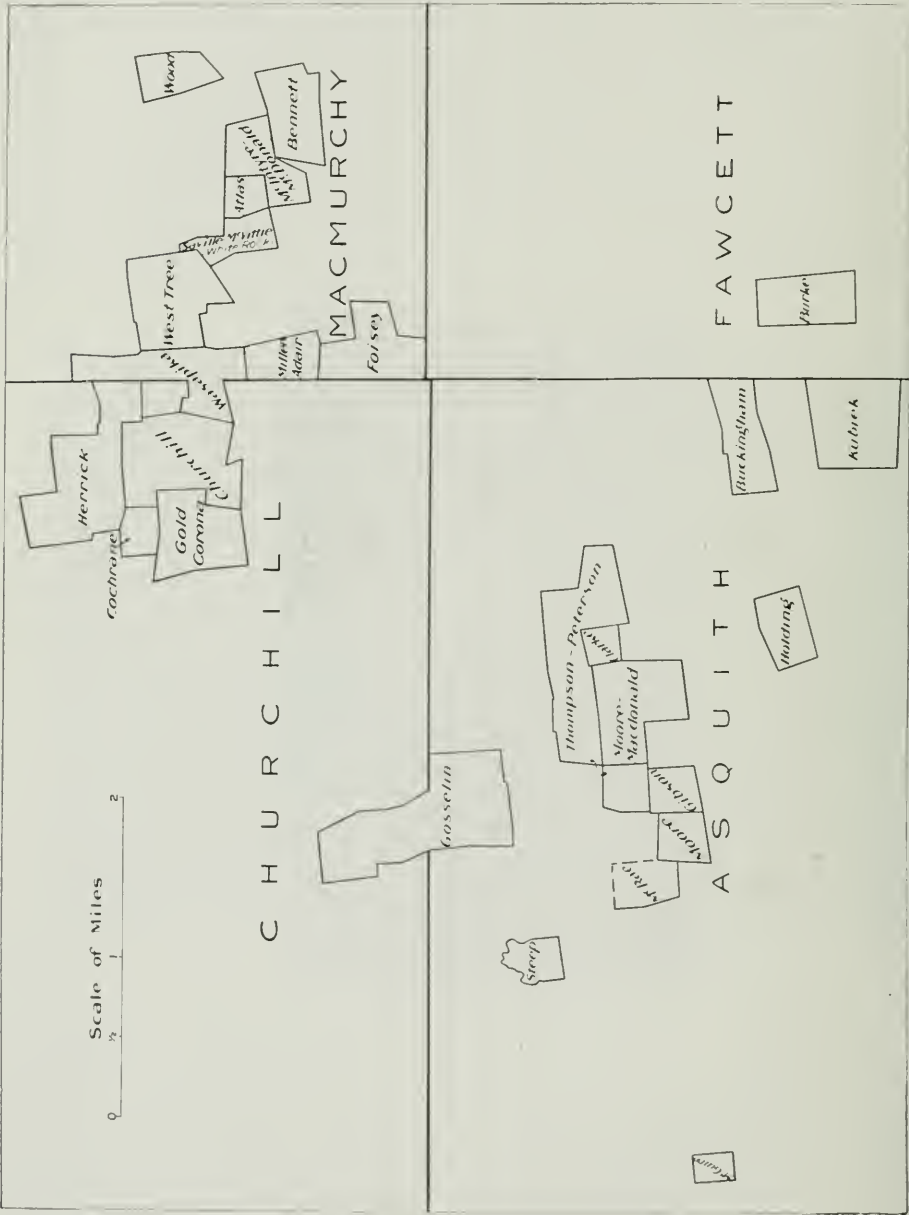
ing being done on a larger scale. The "Ribble" vein which occurs in a chloritic schist extends southerly on the *Miller-Adair*. It is half a mile or more in length and averages at least four feet in width. A cross-cut on the 100-foot level of the *Wasapika* or *Ribble Mines* showed 23 feet of schist and quartz. At the 200-foot level the deposit is reported to be of a nearly similar width. Visible gold was seen by the writer on the 100-foot level and in some parts of the vein outcrop.

Gold-bearing quartz veins of the area have been found in Keewatin and Algoman rocks. They occur largely in the old basic volcanics, as in the case of the "Ribble" vein on the *Wasapika*. A vein carrying gold on the *Churchill* property passes from altered basalt into a rhyolite or porphyry. Gold occurs in quartz cutting iron formation on the *Cochrane* and *Gold Corona*. The *Herrick* vein passes from conglomerate and slate into mica lamprophyre, and has been exploited



Gold-quartz deposit outcropping on the Atlas property, West Shiningtree area.

on the 100-foot level. Coarse gold was seen on the *Clark* claim in quartz stringers, which cut rusty-weathering green magnesium-iron-calcium carbonate. On the *Gosselin*, the gold and quartz occur partly in the porphyry and felsite or rhyolite. Spectacular showings in a nearly transparent quartz on the *Holding* claim are entirely in amphibolite or hornblende schist. Most of the deposits in the vicinity of the *Steep* on West Shiningtree lake, and easterly to the *Buckingham*, occur in bluish grey quartz veins and lenses in shear zones in altered basalt, andesite and rhyolite. There is another type of deposit comprising banded tuff with pyrite or alternating layers of slate and pyrite, resembling iron formation, and carrying only small quantities, e.g., the *Moore*. The deposits on the *West Tree*, *Saville* (*White Rock*), *Atlas*, *McIntyre-McDonald* and *Bennett*, are of the lode type in Keewatin schist. The gold which occurs native and at times contains small quantities of silver, is found in dark seams in the fractured quartz with calcite, sericite talc, chlorite and pyrite. Such minerals as chalcopyrite, molybdenite,



Map showing location of various properties in the West Shinnestree area. (Ont. Bur Mines, Vol. XXIX, Pl. 3, p. 38).

pyrrhotite, barite, galena, tourmaline and specular hematite are present in certain deposits. Pyrite is usually abundant in the wall rock, but on the whole, is scantily distributed in the quartz. Most of the deposits are cut by Keweenawian diabase dikes, usually without being displaced.

Penhorwood and Reeve Townships

"Gold occurs in quartz veins cutting a ferruginous dolomite and chlorite schist—1½ miles north from the northeast corner of Penhorwood township [near Tionaga station]. No free gold is visible, but a sample taken across a vein by the writer yielded upon assay 0.02 ounces to the ton."¹ During 1921, F. Gosselin stated to the writer that he found visible gold in Penhorwood and Reeve townships, 8 miles north of Groundhog station. Considerable work was done on these deposits during 1921.

North of Lake Superior

Gold has been produced at the Empress Mine near Jackfish station, and trial shipments have been made from properties near Schreiber and Big Duck Lake.² These deposits occur in Keewatin schists near Algoman granite or porphyry. Veins carrying gold occur farther north along the Canadian Northern railway near Jellicoe and Kinghorn stations and Little Long Lake, and also on the Canadian National railway near Kowkash and Tashota.

On the *Empress* claim, R. 569, is a large low-grade lode deposit in hornblende schist carrying much pyrite and some chalcopryite, zinc blende and galena. A 10-stamp mill produced some bullion between 1896, and 1899, the ore coming largely from tunnel workings. Gold has been found in the vicinity on the *Ursa Major*, *Victoria Cape*, *Slute Islands*³ and *Bottle Point*.

Some veins in the vicinity of Schreiber on the *McKellar-Longworth* (B. J. 122), *Jackson* (T. B. 3326, 3354), and *Otissee* (T. B. 3412), are narrow and contain rich showings of gold. During 1921, much exploratory work was done on the Jackson and McKellar. On the latter claim gold-telluride-quartz deposits have been found at intervals for half a mile in a pronounced east-west shear zone.

At *Duck lake*, the two principal properties, the *McQuaig* or *Beaver* (T.B. 1686), and the *Sjolander-McKirdy* (T.B. 1861), are largely replacement deposits in which the gangue mineral is nearly all calcite, with considerable included schist and only a few quartz veinlets. Considerable gold in a fine flour state can be seen accompanied with pyrite, chalcopryite, galena and zinc blende. A 45-foot shaft has been sunk on the *McQuaig* vein which passes from quartz porphyry into chlorite schist.

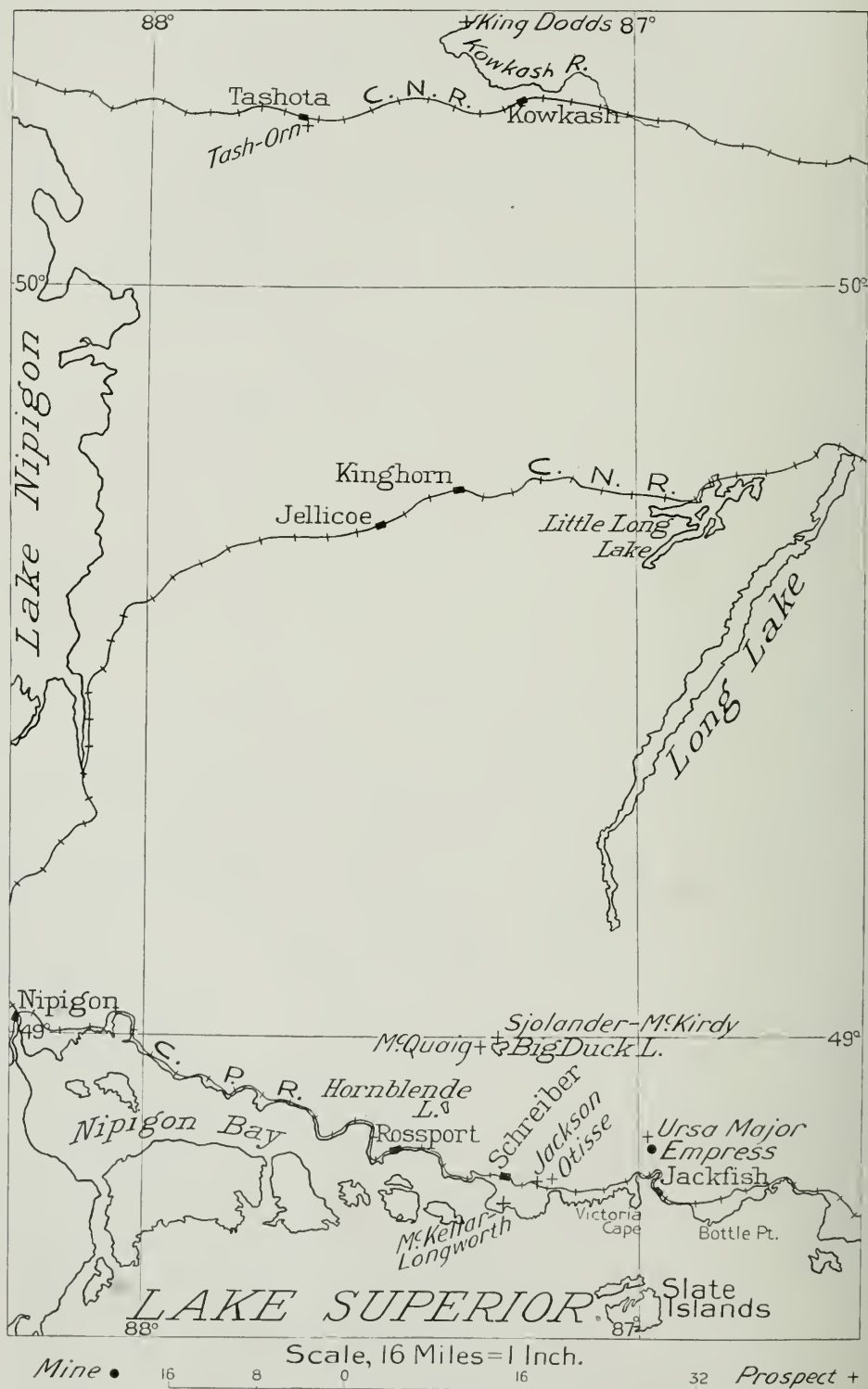
In the vicinity of *Jellicoe* and *Kinghorn* stations, and *Little Long Lake*, A. G. Burrows has obtained low gold values in gold from quartz veins in Keewatin pillow lavas intruded by an occasional felsite or albite porphyry dike. "A three-inch stringer containing quartz, specular iron ore, copper pyrites and iron pyrites, from a rock cut at mileage 145, near *Kinghorn*, gave on assay \$1.20 in gold per ton. In a rock cut one mile to the west of *Jellicoe* there are several lenticular masses of quartz in the basalt. One of these, 15 inches in width, gave on assay \$4.00 per ton. Gold values up to \$2.00 per ton, were obtained from specimens of quartz, schist and iron pyrites from the shores of the west arm of *Little Long Lake*.⁴ In the same area, "on the *Edie* claim near Main narrows, *Little Long*

¹ Sum. Rep. Geol. Sur. Can., 1916, p. 181, with map, by T. L. Tanton.

² Gold at Big Duck Lake, Ont. Bur. Mines, Vol. XXIV, 1915, Pt. 1, pp. 9-13, Schreiber-Duck Lake area, by P. E. Hopkins, Ont. Bur. Mines, Vol. XXX, 1921,

³ Ont. Bur. Mines, Vol. XXVII, 1918, Pt. 1, pp. 155-167, by A. L. Parsons.

⁴ Longuelac to Jellicoe and Orient Bay, by A. G. Burrows, Ont. Bur. Mines, Vol. XXVI 1917 p. 244



Map showing location of gold areas north of Lake Superior along the lines of the Canadian Pacific and Canadian National Railways.

lake, gold occurs in angular fragments of quartz, up to 3 inches in diameter in the drift along the shore."¹ T. Devanney has done considerable work on the Jellicoe deposits.

Kowkash-Tashota Area²

In 1915 gold was found on the *King-Dodds* claim (T.B. 2424) nine miles north of Kowkash station and in the following year on the *Tash-Orn* or *Wells* claim (T.B. 2892) near Tashota station. On the former claim there is a quartz vein up to 6 inches in width, which carries iron pyrites and rich showings of gold, and on which a 90-foot shaft was sunk. The wall rock is Keewatin pillow lava schist cut by Algoman quartz porphyry. The Tash-Orn lode deposit, which occurs in similar rocks, is 8 feet wide and contains visible gold, iron and copper pyrites, native copper and pyrrhotite. A shaft has been sunk 140 feet and some drifting done on the 90-foot level, the deposit containing approximately \$5.00 in gold across 5 feet.

Gold has been discovered on the *Richardson* (T.B. 2599), *Devanney* (T.B. 2650), *Hull* (K.K. 92), *Hendrickson* (K.K. 15), and *Cline* (K.K. 61).

Sturgeon Lake Area³

Since gold was discovered in the area about 1894, the precious metal has been found to be widespread, occurring usually in and genetically connected with Algoman granite and other related types near the contact with Keewatin schists. Sturgeon lake, around which the deposits occur, lies four miles south of Bucke station on the Canadian National railway. According to E. S. Moore, the deposits are composed of lenses and stringers of quartz containing calcite, syenite, pyrite, chalcopyrite, galena, zinc blende, pyrrhotite and gold. Although on four properties stamp mills have been erected, only one, the St. Anthony, has produced an appreciable quantity of gold.

St. Anthony.—Claims B.G. 151, 152, formerly known as the Jack Lake and St. Anthony Reef, have been worked intermittently from 1903 to the present. The total production from the 10-stamp mill according to one owner, George Glendinning, is approximately \$200,000 in gold. The deposit consists of three quartz lenses up to 25 feet in width, extending from the Keewatin into the altered granite, the vein being largely in the latter rock. The workings have reached a depth of 525 feet.

The U.S. Gold Mining Co. or Shore Properties (A.L. 367, 368; B.G. 136) have a 2-stamp mill which yielded a little gold about 1902, from small irregular quartz veins in granite near the greenstone.

Dawson.—The English River Mining Company, formerly the Sturgeon Lake Mining Company, operated the Dawson mine, B.G. 157, with a 10-stamp mill.

Belmore Bay.—A 3-stamp mill was erected on the Belmore Bay mine, S.V. 450.

¹ Geol. Sur. Can. Summary Report, 1917, p. 4E, by T. L. Tanton.

² The Kowkash Gold Area, by P. E. Hopkins, Ont. Bur. Mines, Vol. XXVI, 1917, pp. 190-226.

³ Sturgeon Lake Gold Area, by E. S. Moore; Ont. Bur. Mines, Vol. XX, 1911, Pt. 1, pp. 133-157. Geol. Sur. Can. reports by W. H. Collins, No. 992, pp. 19, 20; No. 1059, pp. 56-58.

Huronian Mine ¹

The first discovery of gold in western Ontario was made in 1871 at the Huronian mine, location H.1 in Moss township. According to A. P. Coleman's report ² the deposit is a bedded vein from 6 to 8 feet wide, of which from 2 to 5 feet are white quartz, the rest being incorporated schists. The gold occurs free, and as sylvanite associated with galena, iron and copper pyrites, and zinc blende. The country rocks are talcose slate, chlorite schist, and altered porphyries [Kewatin]. "A small intrusive area of granite, well exposed on Jackfish Lake, sends an arm southwestward to within a short distance of the mine."³ A 10-stamp mill was built in 1883, and was in operation for part of the following two years.

Atikokan or Upper Seine Area

In the vicinity of Atikokan station, a divisional point on the Canadian National railway, on the Upper Seine waters, are situated the Harold Lake, Elizabeth, Hammond Reef, Saw Bill and Sunbeam (A.L. 282) mines all of which have produced some gold. According to A. P. Coleman,⁴ the country rock on the *Harold Lake* (219X), consists of various yellow and green schists pierced by small eruptive masses or bands of granite or protogine, the last mentioned rock being probably the source of the gold. The deposits are narrow fissure veins up to 2½ feet in width. Some of the veins occur in the granite itself, or at its contact with the schist, and others entirely in the schist. The quartz contains much pyrite, chalcopyrite, galena and in places a good deal of gold. A 5-stamp mill was operated during 1895 and 1896. The *Hammond Reef* (337X, 338X, etc.), is a large stockwork or zone of greatly shattered protogine or altered granite (Laurentian ?) in which quartz has been deposited, filling all the small fissures and cementing the rock together. The deposit is three-quarters of a mile or more in length, and 100 to 300 feet in width; it carries visible gold in some parts. In the quartz and granite are iron pyrites and occasionally a little galena, zinc blende, and magnetite.⁵ A 10-stamp mill was installed in 1897, and an additional 30 stamps were added in 1899, but the mill results were disappointing. The gold-bearing material was quarried. Power was supplied by the hydro-electric plant, about two miles distant. All operations ceased on October 6th, 1900.⁶ On the *Saw Bill* (313 and 314 X), is a quartz vein 4 to 6 feet wide carrying pyrite, chalcopyrite, galena and some free gold. The wall rock is foliated biotite-granite-gneiss or protogine (Laurentian ?). A 10-stamp mill was erected and commenced operation in October, 1897, but very little gold was recovered. The property has remained idle since the autumn of 1897. The workings are about 275 feet deep. The *Sunbeam*, or *A.L. 282*, has a number of short ore shoots confined to a fissure quartz vein, 4 to 5 feet wide, in altered biotite-granite-schist. An incline shaft at an angle of 43 degrees has been sunk 410 feet. Con-

¹ For the geology, see Map. No. 589, Lake Shebandowan Sheet, by W. McInnes, accompanying Annual Report of Geol. Sur. Can., Vol. X, New Series, 1897, or reprint accompanying Vol. VI, 1896, Ont. Bur. Mines.

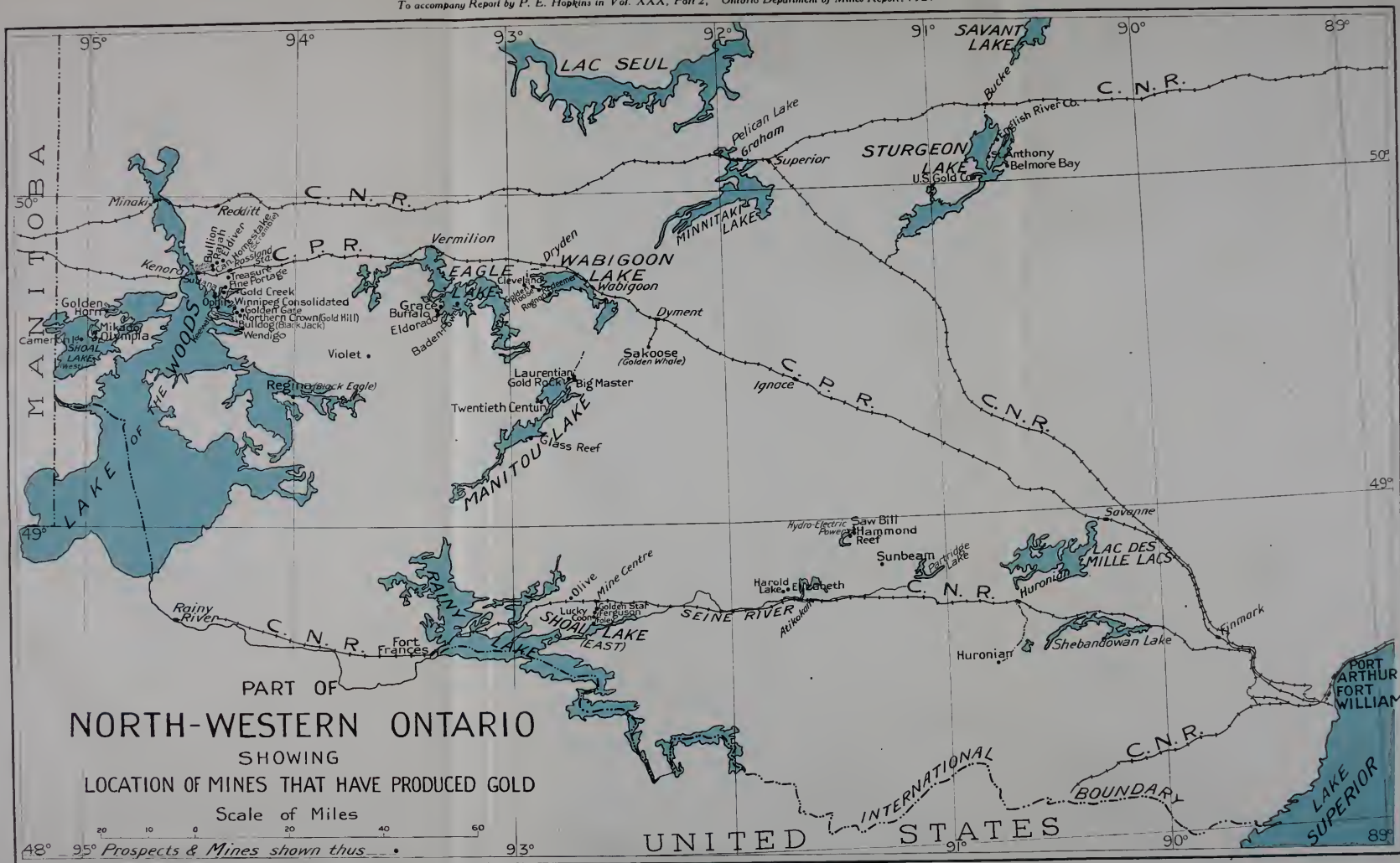
² Ont. Bur. Mines, Vol. V, 1895, pp. 76, et. seq.

³ Geol. Sur. Can., 1897, p. 59 H, by W. McInnes.

⁴ Ont. Bur. Mines, Vol. V, 1895, pp. 69-70; Ibid. Vol. VII, Pt. 2, pp. 130-131 A. P. Coleman.

⁵ Ibid, Vol. IX, 1900, pp. 77-78; Ibid, Vol. X, 1901, pp. 103-104.

⁶ Ibid, Vol. VI, 1896, p. 76, A. P. Coleman.



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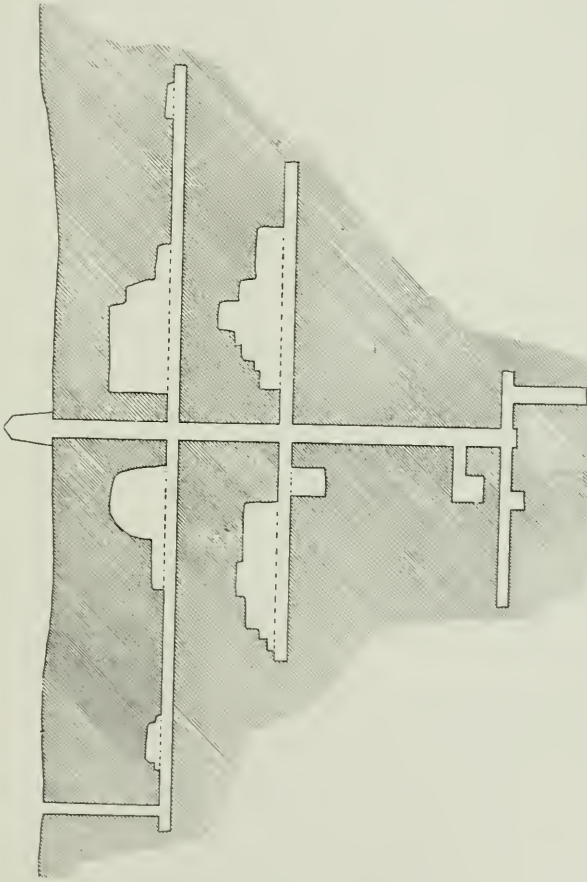
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SAW BILL MINE



Vertical section, scale 100 feet to the inch, of underground workings at Saw Bill mine, north of Atikokan. (Ont. Bur. Mines, Vol. IX p. 77)

siderable gold bullion was produced from a 10-stamp mill erected in 1904, on 614Z., three-quarters of a mile distant from the ore body.¹ The mine has remained closed since the early part of 1905. The *Elizabeth* (F.M. 171, F.M. 172) was discovered in July, 1900, and before it closed, in 1903, a 10-stamp mill had been erected and some bullion produced. The deposit consists of a series of quartz lenses crossing from chloritic schists into altered granite. The quartz is white and granular, like the silica in iron formation.² "The lode is developed by shafts, winzes, and levels to a depth of 280 feet and the gross amount of ore exposed to date (February, 1903), was about 20,000 tons. The width of the stopes varies from 4 to 12 feet, and while there are some rich lenses and shoots of quartz in which the values rise to \$40 and \$50 a ton, the average value may be taken at from \$8 to \$10."³ According to W. E. H. Carter, the pay shoot is 250 feet in length along the course of the vein.⁴ The mine was re-opened and produced bullion during parts of 1912, 1913, and 1914.⁵

Mine Centre, East Shoal Lake or Lower Seine Area

The best geological map of the area is that accompanying A. C. Lawson's report of the Archean Geology of Rainy Lake.⁶ A small portion of the sheet near Vermilion lake has been revised by A. L. Parsons.⁷ Gold was first discovered in the area in 1893 on claim A.D. 2; during the following seven years approximately \$250,000 in bullion was produced from the Golden Star, Foley and Olive, with small amounts from the Ferguson, Lucky Coon and Stone. The veins occur in Keewatin green schists, and in an intrusive boss of Laurentian granite. The granite, which is probably responsible for the gold, is classed as Algoman by A. L. Parsons. The *Foley* (A.L. 74, 75, 76), *Lucky Coon* (P. 655) and *Ferguson* (A.L. 110-112, K. 223) deposits are narrow fissure quartz veins up to a few feet in width in coarse mica-granite or protogine. In places the veins are joined by cross fractures, presenting a stockwork effect, while in other places the veins are small and difficult to trace for any appreciable length. Minerals usually present are pyrite, galena, zinc blende, copper pyrites, and visible gold. The Foley produced in the neighborhood of \$75,000 prior to 1900, from above the 420-foot level. The mine was optioned by the Swedish Mining Syndicate in 1920, and the workings partially de-watered and sampled. The *Golden Star* (A.L. 114, 116, J.O. 4), the principal mine, produced \$161,000 from a lenticular quartz vein in Keewatin basic schist, the shoots averaging \$10.60 across 3½ feet. Underground workings were carried to a depth of 537 feet with 3,500 feet of lateral work. Operations ceased in 1900, and the plant, including a 10-stamp mill, was burned in 1910. A gold-bearing vein occurs in a similar green schist

¹ Ont. Bur. Mines, Vol. XIV, 1905, Pt. 1, p. 56.

² Ibid, Vol. XI, 1902, p. 150, A. P. Coleman.

³ Ibid, Vol. XII, 1903, p. 15.

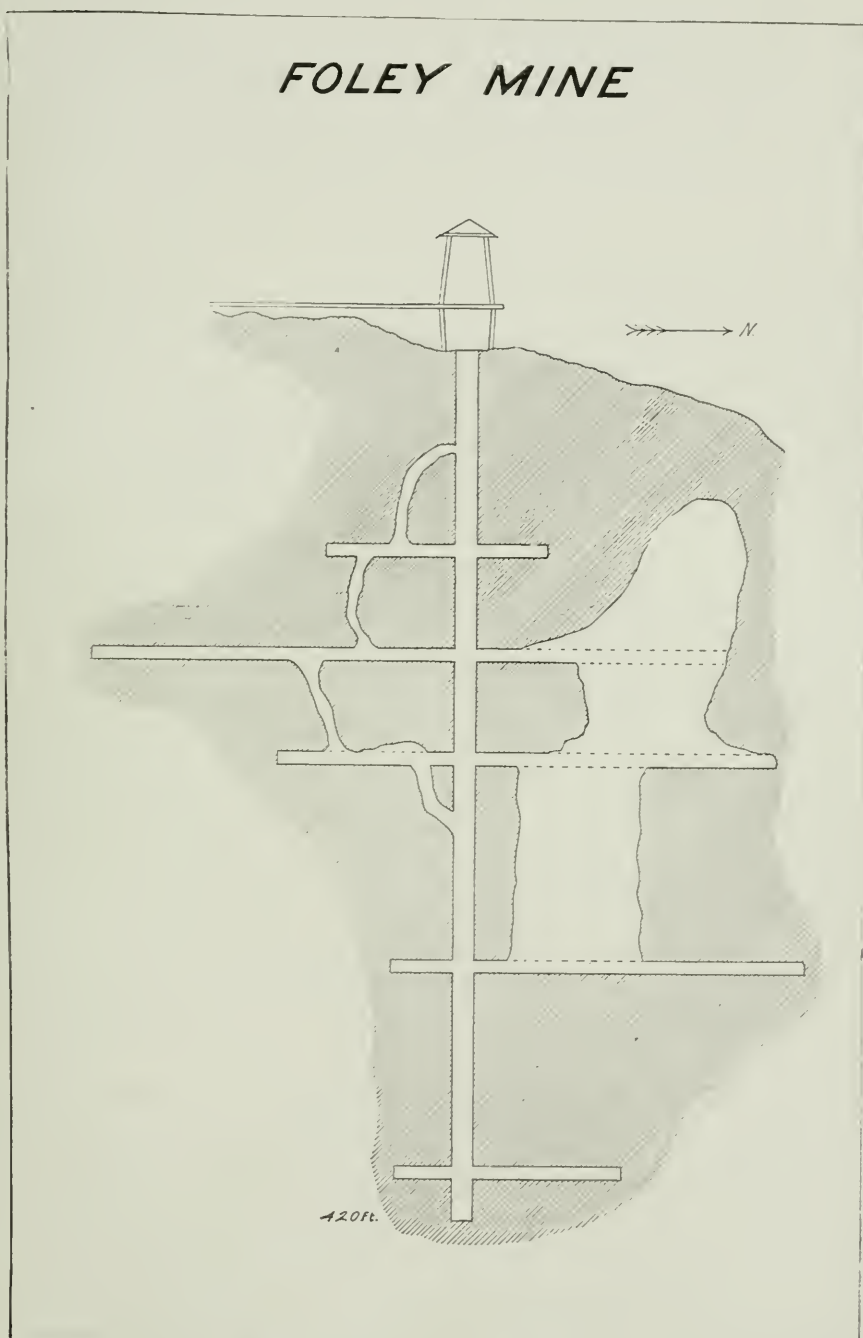
⁴ Ibid, Vol. XI, 1902, p. 241.

⁵ Ibid, Vol. XXII, 1913, p. 99; Ibid, Vol. XXIV, 1915, p. 95.

⁶ Memoir No. 40, Geol. Sur. Can. 1914.

⁷ Map facing page 172, Ont. Bur. Mines, Vol. XXVII, 1918, Pt. 1.

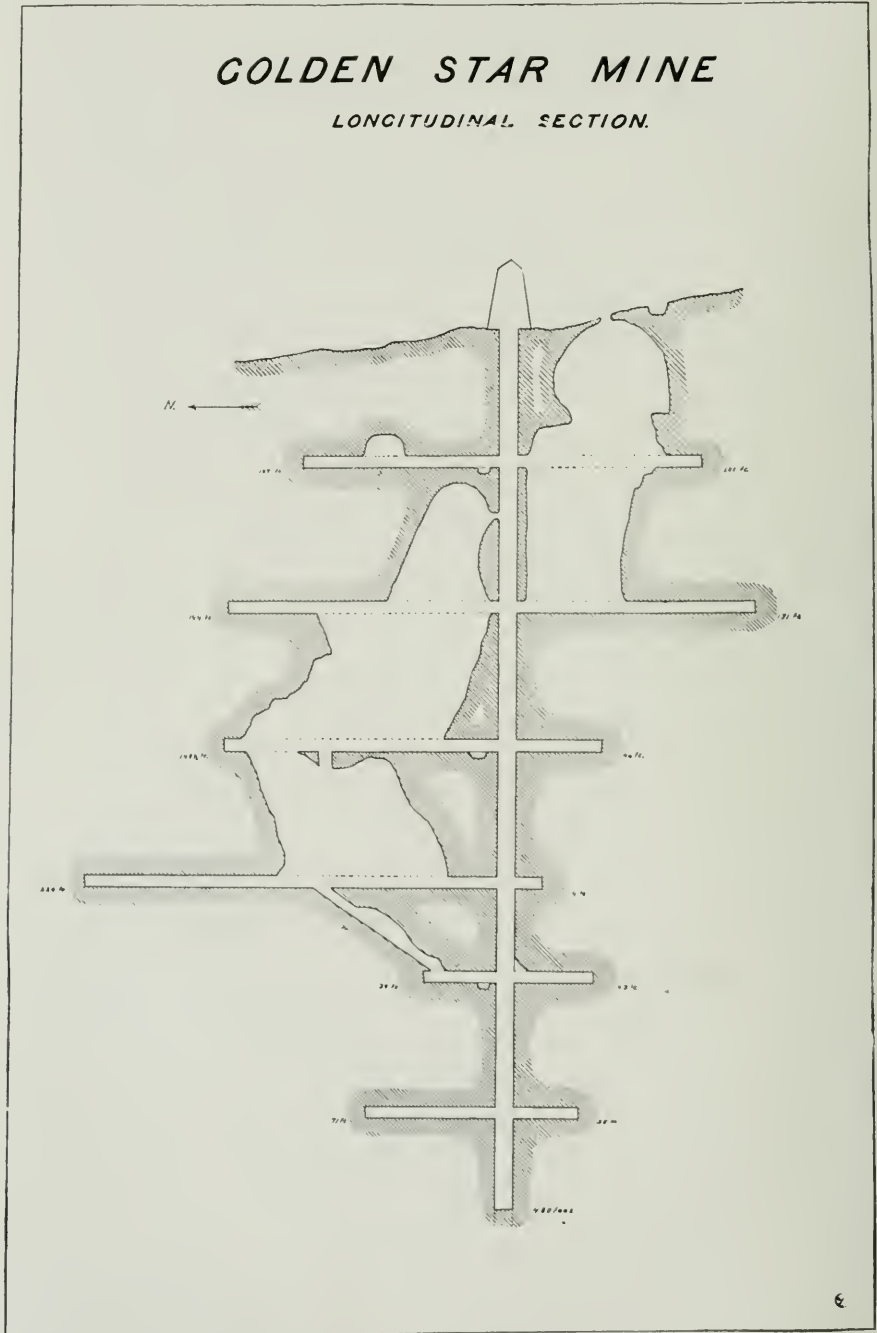
FOLEY MINE



Vertical section, scale 90 feet to the inch, of underground workings at the Foley mine, Mine Centre. (Ont. Bur. Mines, Vol. IX, p. 65).

GOLDEN STAR MINE

LONGITUDINAL SECTION.



Vertical section, scale 105 feet=1 inch, of the workings at Golden Star mine, Mine Centre. (Ont. Bur. Mines, Vol. IX, p. 69).

on the adjoining *Stone* property A.L. 113. The *Olive* or *Preston* (G. 61), according to A. P. Coleman,¹ is on a bedded quartz vein running from 6 inches or less, to about two feet in width in a greenish-grey sericite schist or phyllite, and carrying considerable gold, pyrite, pyrrhotite, chalcopyrite, and dolomite. A. P. Coleman also refers to gold and quartz in felsite schist on *K. 190*, and *K. 191*, north of Potato lake.

Lake Manitou Area

Gold was found in this area about 1895, and the occurrences have been described by A. P. Coleman,² A. L. Parsons,³ and others. The rocks are Keewatin altered diabase, diorite, andesite, agglomerate, and quartz-porphyry. According to A. P. Coleman,⁴ "The deposits are of great variety, fissure veins, bedded quartz veins, schists impregnated with sulphides and dikes of porphyry, all carrying gold to a greater or less extent." A. L. Parsons, describes the deposits as light-coloured schists containing quartz, a considerable percentage of pyrite and some calcite. The following descriptions of the mines are largely from A. L. Parsons' reports:

The *Laurentian* (H.P. 371), began operations in 1903 and produced from a 20-stamp mill the greatest amount of gold from any one property in the area. The main ore body consists of diabase schist and numerous bands of quartz, from a mere trace up to several inches in width, having in all an average width of 20 feet. "The sinking has followed a small vein of dark quartz, which in places produced some showy free gold specimens."⁵ The deposit has been worked to a depth of 480 feet, and ore has been stoped from small shoots on various levels and only in proximity to the shaft.⁶ The *Big Master* (H.P. 366, etc.) vein, according to Mr. Parsons, shows a remarkable similarity to iron formation. A 10-stamp mill produced some bullion between 1902 and 1905. According to the mine plans, the ore shoot in the west vein has been found to widen and lengthen respectively from 2½ feet by 30 feet on the surface, to 8 feet by 156 feet on the second or 185-foot level, and 9 feet width in the winze below this point, (285-foot level), and to have shown an average value of \$17 per ton. The east vein or shoot, so far only opened out along the first or 85-foot level, has a length there of 140 feet, and a width of 12 feet, with an average assay value of \$8.35 per ton."⁷

The *Trentieth Century Mining Company* sank a shaft 340 feet deep on H.P. 398, and installed a 20-stamp mill which produced a small quantity of gold. The stamp mill was later removed to the *Laurentian*. The Company also operated the *Volcanic Reef* (S.40), which has a small quartz vein with pyrite and gold.

¹ Ont. Bur. Mines, Vol. VII, 187, Pt. 2, p. 128.

² Ont. Bur. Mines, Vol. VI, 1896, pp. 83-87; *Ibid.*, Vol. VII, 1897, Pt. 2, pp. 121-123.

³ *Ibid.*, Vol. XX, 1911, Pt. 1, pp. 178-188; *Ibid.*, Vol. XXI, 1912, Pt. 1, pp. 194-198.

⁴ *Ibid.*, Vol. VI, 1896, p. 86.

⁵ *Ibid.*, Vol. XIV, 1905, Pt. 1, p. 52, E. T. Corkill.

⁶ *Ibid.*, Vol. XVIII, 1909, p. 79, E. T. Corkill.

⁷ *Ibid.*, Vol. XIV, 1905, Pt. 54, W. E. H. Carter.

The *Paymaster* (H.W. 20) has a schist quartz vein in diabase which has been opened to the 325-foot level. A 10-stamp mill is on the property. Other prospects are the *Victory* (McA. 28), *Jubilee* (H.P. 301) with a 4 or 5-foot fissure vein, *Little Master* (H.P. 315), *Detolu* (R.P. 411), and *Last Chance* (S. 28). In the early part of 1916, the Laurentian, Big Master, and Jubilee were de-watered and sampled by the Dominion Reduction Company of Cobalt, but no further work was done by the Company. The *Glass Reef* (H.W. 391, H.W. 594) produced a little gold from a 10-stamp mill.

The *Sakoose* or *Golden Whale*¹ (H.W. 416, etc.) near Dymont station in the New Klondike region, mined and shipped ore to the Keewatin Reduction Works at Keewatin, Ontario, during 1899 to 1902. "The ore consists of a dark quartz containing variable quantities of zinc blende, chalcopyrite, pyrites and galena, lying in a fissure tight against the walls of brownish grey disturbed quartzose schist [felsite] . . . A dike of quartz porphyry runs in and out through this broken up area of country rock and for long stretches lies against the quartz veins."²

Dryden

The geology of this area is included in Wm. McInnes's³ Manitou Lake sheet. Further detailed work around Wabigoon lake was done by A. L. Parsons⁴ and Ellis Thomson.⁵ According to Mr. Thomson, the veins occur chiefly in the Keewatin, particularly near the Laurentian formation. The veins vary in width from a few inches to 20 feet or more, and consist chiefly of white quartz; ankerite, pyrite and black tourmaline are also quite plentiful, while chlorite, malachite, azurite, hematite, and native gold are rarer constituents. Only a small quantity of gold has been produced from three or four properties.

The *Redeemer*,—(S.W. ¼, S. ½, lot 7, con. 1, Van Horne), produced a small quantity of gold in 1905, from a 10-stamp mill. The deposit is apparently a lode of quartz and green schist with much pyrite, which has been worked to a depth of 235 feet with levels at 100 and 200 feet. The upper workings were de-watered in 1910, and later in 1919, by the *Contact Bay Mining Company*. This company also operates the *Rognon*,⁶ K. 635, (formerly the surveyed claim A.S. 14), where the vein "varies in width from two feet two inches, pinching and swelling alternately throughout the length. The vein material is reddish quartz highly impregnated with hematite and occasionally carrying a little pyrite"⁷ and visible gold. The country rock is biotite schist. A shaft has been sunk 106 feet with 65 and 192 feet of drifting at the 50 and 100-foot levels respectively. A little gold has been recovered from a one-stamp testing mill⁸. At the

¹ Ont. Bur. Mines, Vol. X, 1901, pp. 89, 90, 101, 102.; Ibid, Vol. XI, 1902, pp. 11, 53, 57, 251, 255; Ibid, Vol. XII, 1903, p. 15.

² Ibid, Vol. X, 1901, p. 101, W. E. H. Carter

³ Map No. 720, Manitou Lake Sheet, Rainy River District, Geol. Sur. Can. 1902.

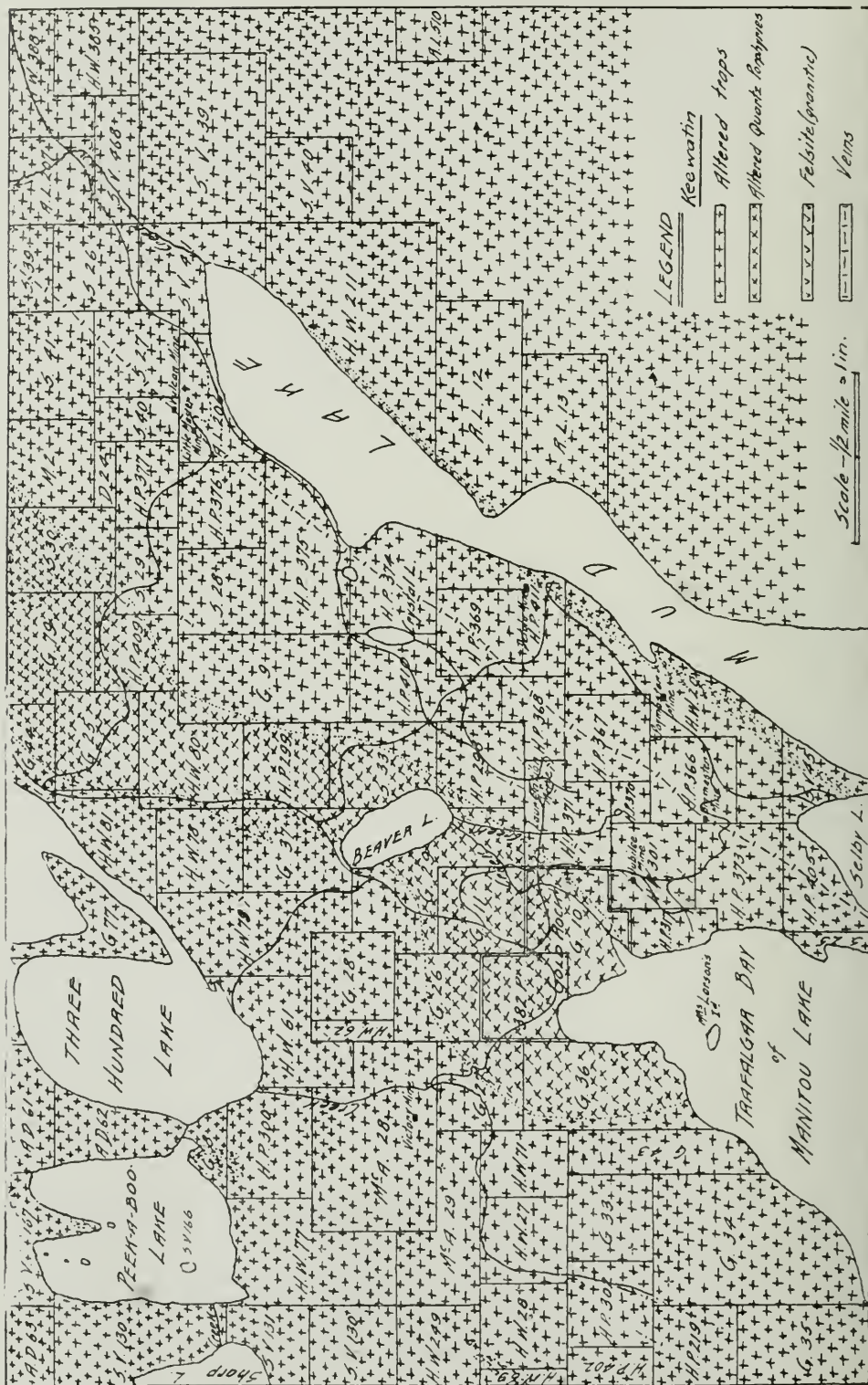
⁴ Map on page 120. Ont Bur. Mines, Vol. XX, 1911, "Gold Fields of Lake of the Woods, Manitou and Dryden".

⁵ Dryden Gold Area, by Ellis Thomson, accompanied by a geological coloured map, scale 8 miles to 1 in., Ont. Bur. Mines, Vol. XXVI, 1917, pp. 163-189.

⁶ Can. Min. Jour., Dec. 10, 1915, by Jas. Bartlett.

⁷ Ont. Bur. Mines, Vol. XXIV, 1917, p. 184, E. Thomson.

⁸ Ibid, Vol. XXIX, 1920, p. 66.



Geological map of the Manitou area by A. L. Parsons. The altered traps include diabase, diorite and andesite. (Ont. Bur. Mines, Vol. XX, Pt. 1, p. 79).

Gold Moose (lot 8, con. 1, Van Horne), the shaft has been sunk to a depth of 114 feet. The vein, which is in trap, is 18 inches wide at the surface and 4 feet wide at the bottom. "In February of this year [1901] a mill test of 67 tons of ore made at the Keewatin Reduction works, is said by Hutchison Bros, to have given satisfactory returns."¹

The League mine (N. 1 $\frac{1}{2}$, lots 5 and 6, con. 1, Van Horne) shows a vein consisting of quartz, ankerite, tourmaline, and pyrite with green mica and chalcopyrite. The country rock is dense felsite or quartz-porphry. The shaft is 80 feet in depth. A one-stamp mill is on the property.² The *Cleveland* (lot 11, con. 1, Van Horne), has an 80-foot shaft on a small quartz vein in altered diabase.

Gold has also been found to the northeast of Dryden, on the Cross and other claims on *Minnitaki lake*.³

Eagle Lake

The geology has been worked out by Wm. McInnes in the *Maniton Lake* sheet of the Geological Survey of Canada, and is further discussed by W. G. Miller, W. E. H. Carter, E. T. Corkill, A. L. Parsons and others who also treat of the properties on which work has been done.⁴ The important gold-bearing veins of the area are confined to the granite over a width of a mile or more from the contact with the green trap, which contact crosses Eagle lake with a tortuous but on the whole northeast-southwest strike.⁵

The *Grace* gold mine (M.H. 251), lies near the contact of Laurentian granite and altered quartz-porphry of Keewatin age. Six veins have been located and a shaft sunk 135 feet on No. 1 vein where one level has been opened up. The vein consists principally of schist and bluish quartz. A tunnel has been driven into the hill 160 feet.⁶ According to W. E. H. Carter, the veins are quite narrow, carrying galena, blende, pyrite and an unusual sprinkling of visible gold.⁷ A 5-stamp mill was erected in 1907, and a little ore milled.⁸ The *Golden Eagle* in 1903 had 29 tons of ore run through the Eldorado mill, producing \$307.50 in gold.⁹ The following four properties, some of which produced bullion in 1903, 1901, and 1905, have been worked by the *Northern Light Mining Company*. The *Baden-Powell* (S. W. end of South Twin island) has three quartz veins in granite, probably of Laurentian age. About 40 tons of ore were tested at the Eldorado mill.¹⁰ Later, a 5-stamp mill was erected and a shaft put down 135 feet.¹¹ The *Eldorado* (M.H. 257), has a 31-foot shaft on a vein in Laurentian granite. A 2-stamp mill was erected. Considerable exploratory mining was also done on the *Buffalo* (M.H. 246), and on *Pioneer Island* (McA. 245). On the latter an 80-foot shaft has been sunk on a vein of pyrite and quartz on a contact of granite and trap.¹²

¹ Ont. Bur. Mines, Vol. XI, 1902, p. 244, W. E. H. Carter.

² Ibid, Vol. XXVI, 1917, p. 181, Ellis Thomson.

³ Ibid, Vol. VIII, 1898, pp. 69-72; Vol. IX, 1899, p. 64.

⁴ Ibid, Vols. XII, 1903, to XVII, 1908, inclusive and Vol. XX, 1911.

⁵ Ibid, Vol. XX, 1911, p. 196, A. L. Parsons.

⁶ Ibid, Vol. XIII, 1904, p. 64, W. E. H. Carter.

⁷ Ibid, Vol. XIII, 1904, p. 64, W. E. H. Carter.

⁸ Ibid, Vol. XVII, 1908, p. 64, E. T. Corkill.

⁹ Ibid, Vol. XIII, 1904, p. 64, W. E. H. Carter.

¹⁰ Ibid, Vol. XII, 1903, p. 93, W. G. Miller.

¹¹ Ibid, Vol. XX, 1911, p. 197, A. L. Parsons.

¹² Ibid, Vol. XIV, 1905, p. 49, W. E. H. Carter.

Lake of the Woods and West Shoal Lake

The geology of Lake of the Woods has been worked out in detail by A. C. Lawson¹ and minor changes and additions have been made by A. P. Coleman, and A. L. Parsons. Prof. Coleman² wrote three detailed reports on the "Western Ontario Gold Regions," in 1894, 1895, and 1896. Later, in 1910, 1911, and 1912 Mr. Parsons³ did detailed mapping in the vicinity of some of the mines and reported on the accessible properties. These have been described from year to year by the Mining Inspectors of Ontario, and a brief account is given in the International Geological Guide Book No. 8 published by the Geological Survey of Canada, in 1913.

Gold mining began around Lake of the Woods about 1883, the greatest activity being in the year 1897. The principal producers were: the *Sultana* which yielded between \$700,000 and \$1,000,000 the *Mikado*, and the *Regina* or *Black Eagle*; the production of the latter two was approximately \$500,000 each. Small quantities of bullion have come from Ophir, Olympia, Golden Horn, Cornucopia, Cameron Island, Winnipeg Consolidated, Pine Portage, and the Keewatin Contact. The production from a number of the smaller properties was obtained from mill tests only. Mining has been carried on intermittently at most of the properties; none of the mines were in operation during 1920.

The rocks are of pre-Cambrian age, consisting of Keewatin hornblende, chlorite, sericite schist, etc., Laurentian granite and gneiss, a series of granites, porphyries and felsites younger than the Laurentian (probably Algoman), and a few Keweenawian diabase dikes. The Keewatin hornblende schists, altered traps, are the most important rocks, since the main ore deposits are located in them, as at the *Sultana*, *Regina*, and *Mikado*; the ore in the latter two mines also extends into the adjoining granite, which may be responsible for the gold.

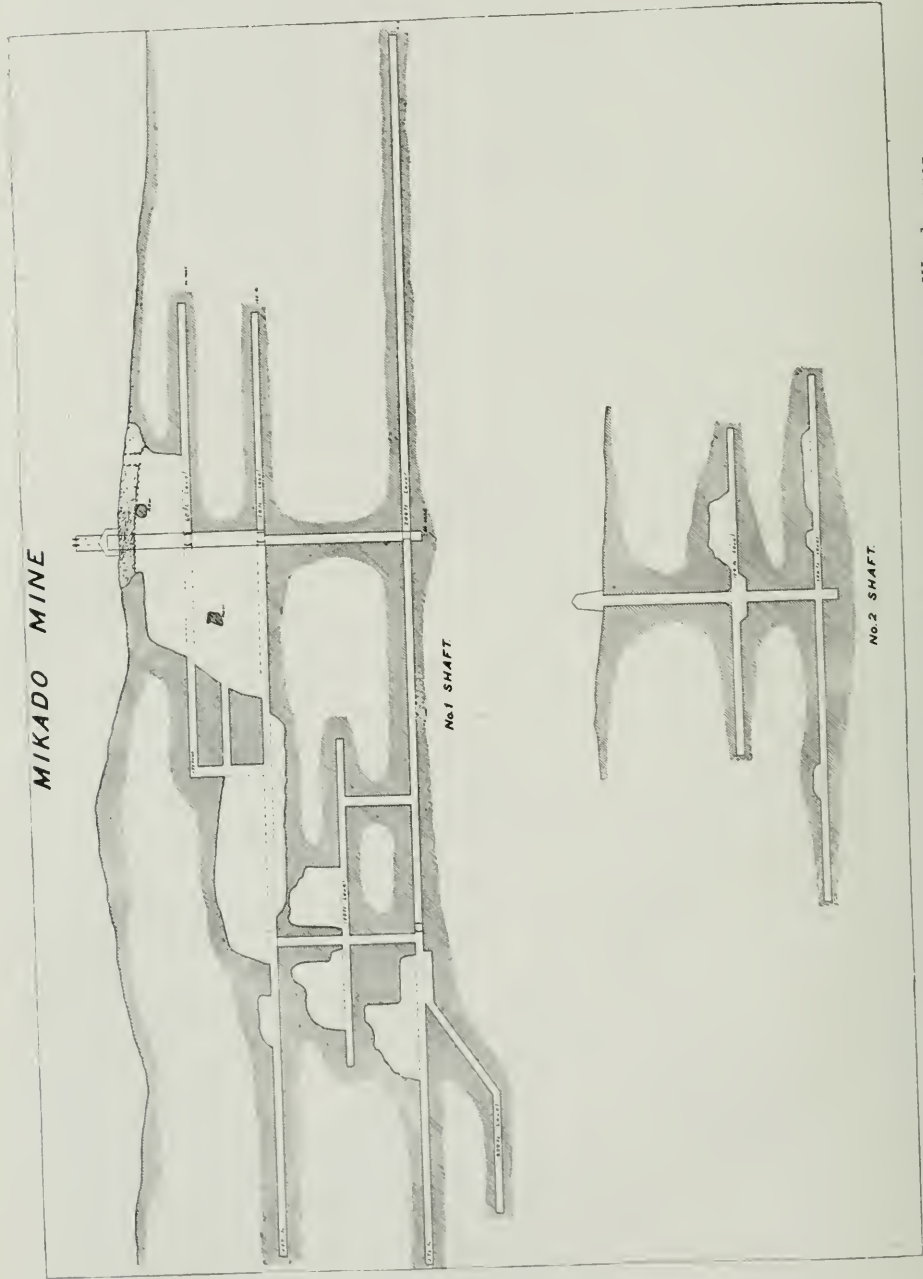
The veins are chiefly of the fissure type, with quartz and some ferro-dolomite. They frequently cut across the contact between granite and Keewatin altered volcanics.

The *Mikado* (D. 148) was discovered in 1893, operated up to 1903, and again in 1910 and 1911. The mine produced approximately \$500,000 in gold, the ore running \$8 and up per ton. According to A. L. Parsons, the rocks are Keewatin traps, basalts altered to hornblende and chlorite schists and andesite and quartz porphyry, which have been intruded by felsite dikes and sills, and granite. The main vein is of the fissure type and consists of blue and white quartz averaging from 4 to 5 feet in width and carrying pyrite, chalcopyrite, bis-muthinite, molybdenite, malachite, native gold, chlorite, and tetradymite. An inclined shaft has been sunk to a depth of 540 feet, 1,300 feet on the incline, and nine levels have been opened up. The stoping has been done principally in the felsite and for a short distance in the adjoining traps. A less important

¹ Report on the Geology of Lake of the Woods Region, Ont., Geol. Sur. Can. Annual Rep., 1885, Pt. CC; See also reprint of Prof. Lawson's map in Ont. Bur. Mines, Vol. VI.

² Ont. Bur. Mines, Vols. IV, 1894, V, 1895, and VI, 1896.

³ Ibid, Vols. XX, 1911, XXI, 1912, and XXII, 1913.



Vertical section of underground workings, Mikado mine, Lake of the Woods area, scale, 1 inch=160 feet. (Ont. Bur. Mines, Vol. IX, p. 53).

vein occurs in the adjoining granite¹. The best values are always found where one or both walls are composed of granite². The mine may be re-opened during 1922.

The *Cornucopia* (Cedar Island No. D. 212). The shaft was sunk on a vein carrying much pyrrhotite. The gold recovered was valued at \$1,560.

The *Olympia* (M. 11) has a quartz-calcite vein from 3½ to 6 feet in width in Keewatin diabase. Gold valued at \$2,101, was produced in 1912 from a 10-stamp mill. Some ore was also milled in the summer of 1915. There are five shafts and three tunnels on the property³.

Cameron Island.—(S. 170). The rocks are amphibolite, altered trap, intruded by felsite. The main quartz vein is four feet wide carrying much pyrrhotite, pyrite and chalcopyrite⁴. A mill run in a 5-stamp mill yielded \$200 in gold the ore averaging about \$10 per ton. According to T. F. Sutherland,⁵ the shaft has been sunk 132 feet with 500 feet of lateral work on the 63 and 127-foot levels. The mill has been replaced by two Forsythe pulverizers, a rotary roasting kiln and two amalgamation plates.

Golden Horn or Rush Bay (D. 288) produced some gold in 1905 from a 2-stamp mill. According to W. E. H. Carter, "the vein is very irregular in width, waving in and out from a mere stringer to a solid quartz body 3½ feet wide. The one solid band occasionally breaks up into several, which then interband with the chloritic schist forming a well-defined deposit several feet wide."⁶ The quartz varies from a white variety with a little iron pyrites to a smoky quartz carrying galena, blende, chalcopyrite and pyrite.⁷ "No. 1 shaft has been sunk, to a depth of 225 feet, and 175 feet of drifting has been done in both directions on the vein on the first level. On the third level a cross-cut has been driven south 285 feet. No. 2, shaft is 113 feet deep on a vein 84 feet south of No. 1, vein."⁸

The *Regina* mine (556 P. 557 P.), later known as the *Black Eagle*, began mining and milling in 1895 and worked continuously until October, 1899. The property was in operation for a short time during 1902 and also in 1905, the total production being approximately \$500,000. The ore occurs as a nearly vertical chimney or ore shoot in a "true fissure" vein. According to A. L. Parsons⁹ "The vein upon which the shaft is sunk varies in width from about 2 feet to 6 feet with a general average [in the four upper levels] of about 4 feet, and at only one place was a width of less than two feet noted. The vein cuts the contact of granite and a more or less altered trap [the ore occurring in both formations] . . . The shaft has been sunk to a depth of 545 feet and nine levels have been opened up at intervals of 60 feet . . . The vein is principally quartz, though in places a fair

¹ Ont. Bur. Mines, Vol. XX, 1911, pp. 164-5; Vol. XXI, 1912, pp. 192-3.

² Ibid, Vol. XII, 1903, p. 95, W. G. Miller.

³ Ibid, Vol. XX, 1911, p. 162; Vol. XXV, 1916, Pt. 1, p. 68.

⁴ Ibid, Vol. XX, 1911, p. 166, A. L. Parsons.

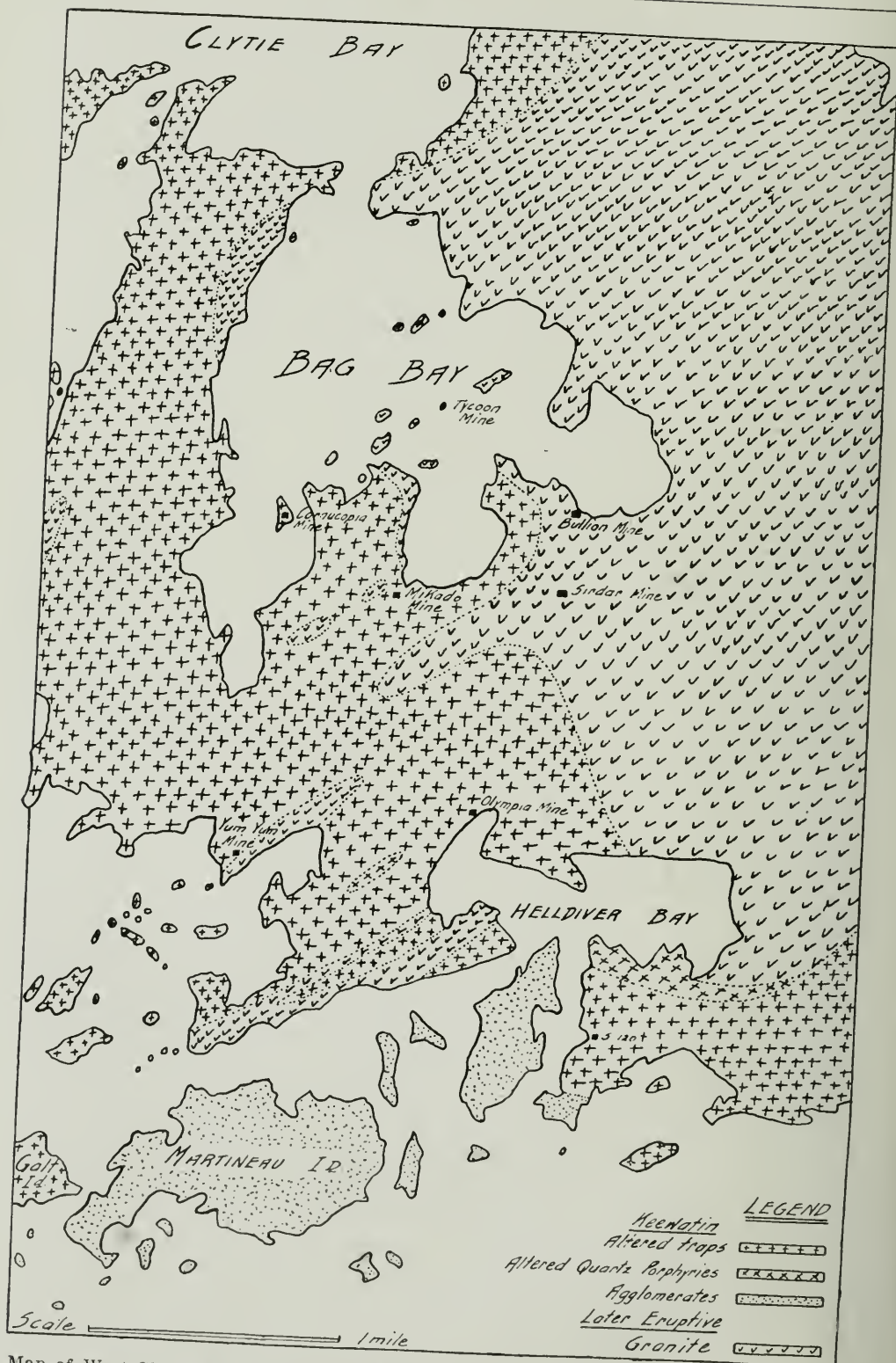
⁵ Ibid, Vol. XXV, 1916, p. 66.

⁶ Ibid, Vol. XIII, 1904, Pt. 1, p. 61.

⁷ Ibid, Vol. XI, 1902, p. 252.

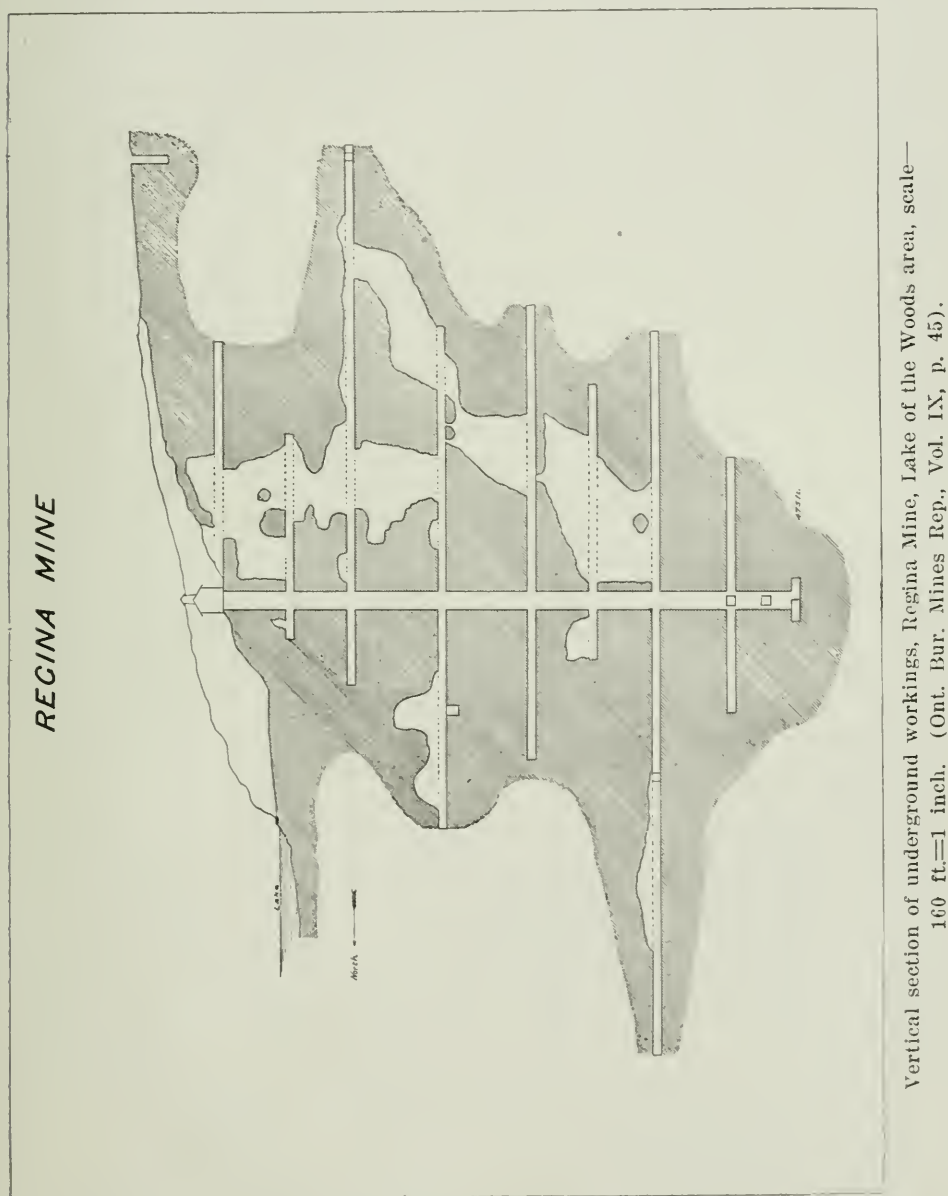
⁸ Ibid, Vol. XV, 1906, p. 59, E. T. Corkill.

⁹ Ibid, Vol. XX, Pt. 1, p. 173.



Map of West Shoal lake, Lake of the Woods area, by A. L. Parsons, (Ont. Bur. Mines, Vol. XX, Pt. 1, p. 79).

percentage of a rusty carbonate is found intermingled with the quartz." According to James A. Bow,¹ the stope, which has been carried through from the sixth level to the surface, averages about 6 feet in width and is approximately 60 feet in length on the levels; the vein in the lower workings is 7 to 12 feet



in width, possesses good walls and averages about \$7 per ton. Gold has also been found on the property in quartz veins in granite, and in quartz stringers cutting rusty carbonate. There is a 40-stamp mill and other buildings and equipment. Cyanide was used in recovering the gold.

¹ Ont. Bur. Mines, Vol. VIII, 1899, p. 57; Vol. IX, 1900, p. 46.

The *Canadian Homestake*, formerly known as the *Scramble* (lots 13. and 14, concession VI, Jaffray township), was located in 1894, and was partially explored. After lying idle for thirteen years the property was re-opened in 1911, and operated by electric power from Kenora. According to A. L. Parsons, the ore body is a fahlband about 30 feet wide, containing veins and stringers of quartz and ankerite and considerable pyrite, and resembles iron formation occurring in altered diabase which in places exhibits a pillow structure.¹ "The company continued development work until September 15th, 1914, when all work was stopped. At that date the underground development stood as follows:—The shaft was 225 feet deep and timbered to 200 feet. On the 55-foot level a cross-cut was driven a distance of 60 feet. On the 75-foot level a cross-cut was driven 27 feet and a sump cut. On the 200-foot level a drift was driven 100 feet and a sump cut."²

The *Sultana mine* (42X) began operation in 1891 and worked almost continuously until it closed in 1906, the production during that time being between \$700,000 and \$1,000,000, which is the largest yield from any gold mine in north-western Ontario. The ore averaged about \$8.00 per ton and had a fineness of about 840. The workings are about 600 feet deep, which is the greatest depth reached in any gold mine in this area. According to A. P. Coleman³ the deposits are bedded veins [lodes?] in Keewatin hornblende and chlorite schist [altered trap] near granite and granite-porphry which may be of Laurentian or later age. Some veins are also in the granite. "In addition to native gold it is reported that considerable molybdenite was found in this mine, and the tailings along the shore show that there was a large quantity of pyrite and other sulphides in the vein".⁴ "The latest developments appear to show that the ore body is a large irregular chimney extending through all the levels from the second down."⁵ The main stope has a minimum cross-section of about 25 feet by 25 feet and a maximum of about 60 by 120 feet. The ore shoot was cut off by a fault on the seventh level.⁶ There is a 30-stamp mill and other surface equipment.⁷

The *Ophir* (A. 20) vein is entirely in unaltered granite porphyry (Laurentian?) near Keewatin altered trap. A little gold was obtained in 1911. According to A. L. Parsons,⁸ a shaft has been sunk 160 feet deep with levels at depths of 40 and 100 feet. The vein is apparently a lode consisting of a few lenses and bands of quartz separated by micaceous and chloritic material and granite-porphry.

Winnipeg-Consolidated (F 22, and X 85).—A. L. Parsons says, "The vein of the Winnipeg Consolidated mine was seen in the shaft, and at a depth of 6 feet it has a thickness of about three feet and is between walls of altered diabase."⁹ Ore was mined and milled in 1883. According to E. Ooste, "the true vein of massive quartz . . . was found to be narrow (6 inches to 2 feet); it is certainly

¹ Ont. Bur. Mines, Vol. XX, 1911, p. 175; Vol. XXII, 1913, p. 227.

² Ibid, Vol. XXIV, 1915, p. 96.

³ Ibid, Vol. IV, 1894, p. 68.

⁴ Ibid, Vol. XX, 1911, p. 169, A. L. Parsons.

⁵ Ibid, Vol. VIII, 1899, p. 50, James A. Bow.

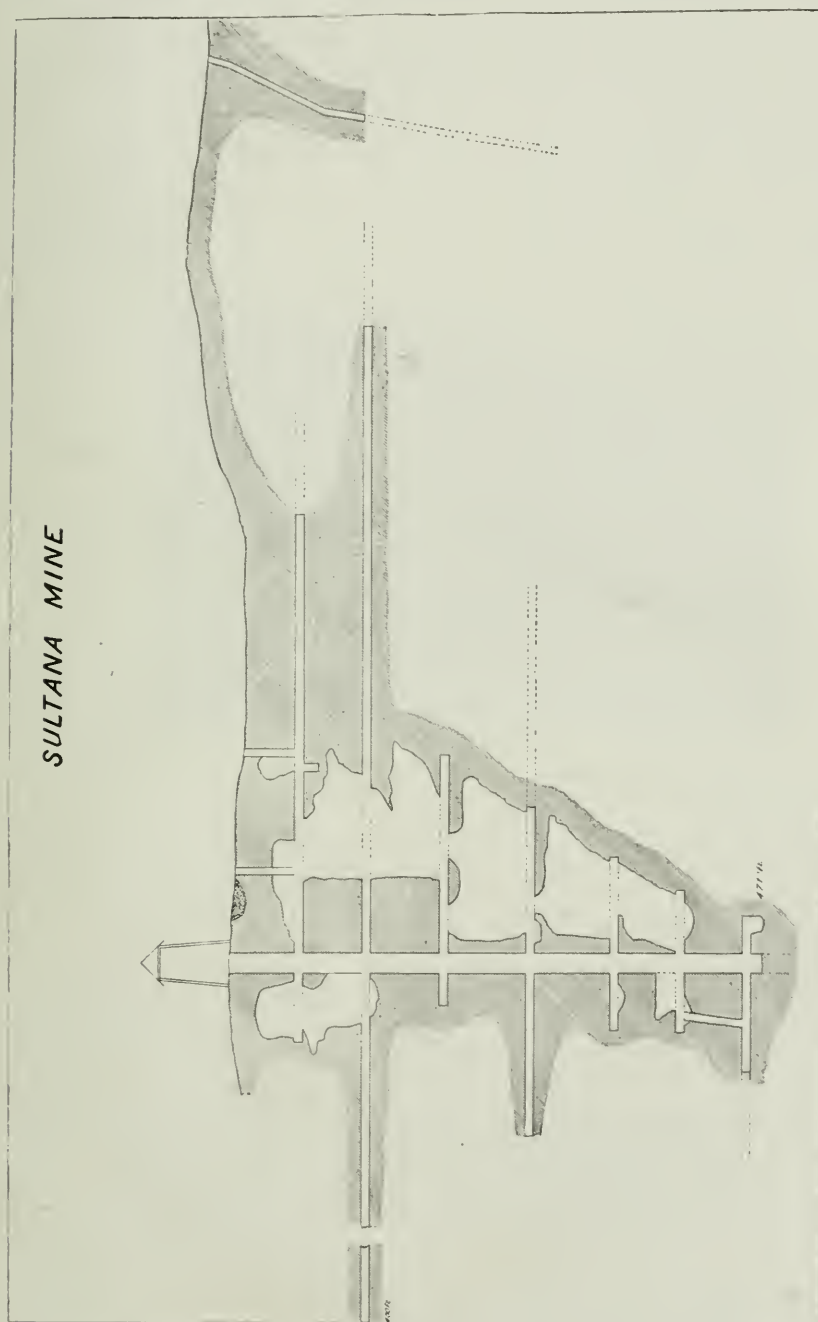
⁶ Jour. Can. Min. Instit., Vol. VII, 1897, p. 132, W. E. H. Carter.

⁷ Ont. Bur. Mines, Vol. XX, 1911, Pt. 1, p. 170.

⁸ Ibid, Vol. XXII, 1913, Pt. 1, pp. 226-7.

⁹ Ibid, Vol. XX, 1911, p. 172.

auriferous . . . , it contains besides iron and copper pyrites, mispickel, a little calcite and a very little galena and blende.¹²⁷



Underground workings of the Sultan, Lake of the Woods area, scale: 170 ft.=1 inch
The shaft is now 600 feet deep and a drift on the third level has reached the Crown
Reef vein, 750 feet from the main shaft, where some ore was stoped.
(Ont. Bur. Mines, Vol. IX, p. 39).

Pine Portage.—"Ore was milled as it was taken from a 100-foot shaft in 1884. The vein is a quartz fissure over 7 feet in width; it is certainly very auriferous and is impregnated with iron and copper pyrites, blende, galena, mispickel

¹ Geol. Sur. Can., 1882-4, p. 11k, 12k.

and a little covellite.”¹ The lead is a fissure cutting a hard massive schistose hornblende rock at a distance of only 150 feet from a granite mass towards which it dips.”²

Keewatin.—“In 1884, ore was shipped in barges to the stamp mill of the Argyle mine. The quartz, which is rich in iron and copper pyrites and in mispickel, runs in small veins between the laminae of the schist, forming a total width of about six feet of impregnated matter.”³

The Combined mine lies two miles east of the south end of Camp bay—“37 tons of ore were milled in July, [1903], producing gold, according to the superintendent, to the amount of \$10.50 per ton.”⁴ “The vein is nearly horizontal . . . lies between overlying trap, exhibiting a pillow structure, and a dark underlying



Flat quartz vein overlain by trap, Combined gold mine, Lake of the Woods area. (Ont. Bur. Mines, Vol. XIII, Pt. 1, p. 48).

felsite or fine-grained quartz (?) porphyry. With the quartz, which in the principal vein varies from two to four feet in thickness, is a large body of rusty carbonate rock which seems to be derived from the alteration of quartz (?) porphyry or felsite and shows considerable sericite.⁵

Numerous other prospects in the area have made mill tests or shipped ore to the smelters, from which a few hundred dollars were recovered. A number of the following come under this class: *North Crown* (formerly called *Gold Hill*, 70 K); *Homestake*, P. 64; *Champion* or *Good*, P. 349; *Gold Creek*, P. 347; *Eldiver*, P. 351; *Treasure*, P. 400; P. 409; *Caribou*, P. 288; *Bulldog* or *Black Jack*, X. 90; *Rajah*, P. 317; *Standard*, McA. 251; *Bully Boy*, S. 79; *Triggs*, McA. 56; *Flint Lake*, McA. 285, 286; *Crown Point*; *Bullion*; *Triumph*; *None-such*; *Boulder Island*; *Golden Gate*; *Master Jack*; *Dead Broke* or *Climax*; *Princess*; *Black Sturgeon*; *Sirdar*; *Tycoon*; *Yum-Yum*; *Nino*; J.E.S. 93; *Violet*, (produced gold in 1907).

¹ Geol. Sur. Can. 1882-1884, p. 15k, E. Coste.

² Ibid 1885, pp. 141, 142, CC., A. C. Lawson.

³ Ibid, 1882-1884, p. 10K.

⁴ Ont. Bur. Mines, Vol. XIV, 1905, p. 48.

⁵ Ibid, Vol. XXI, 1912, p. 190, A. L. Parsons.

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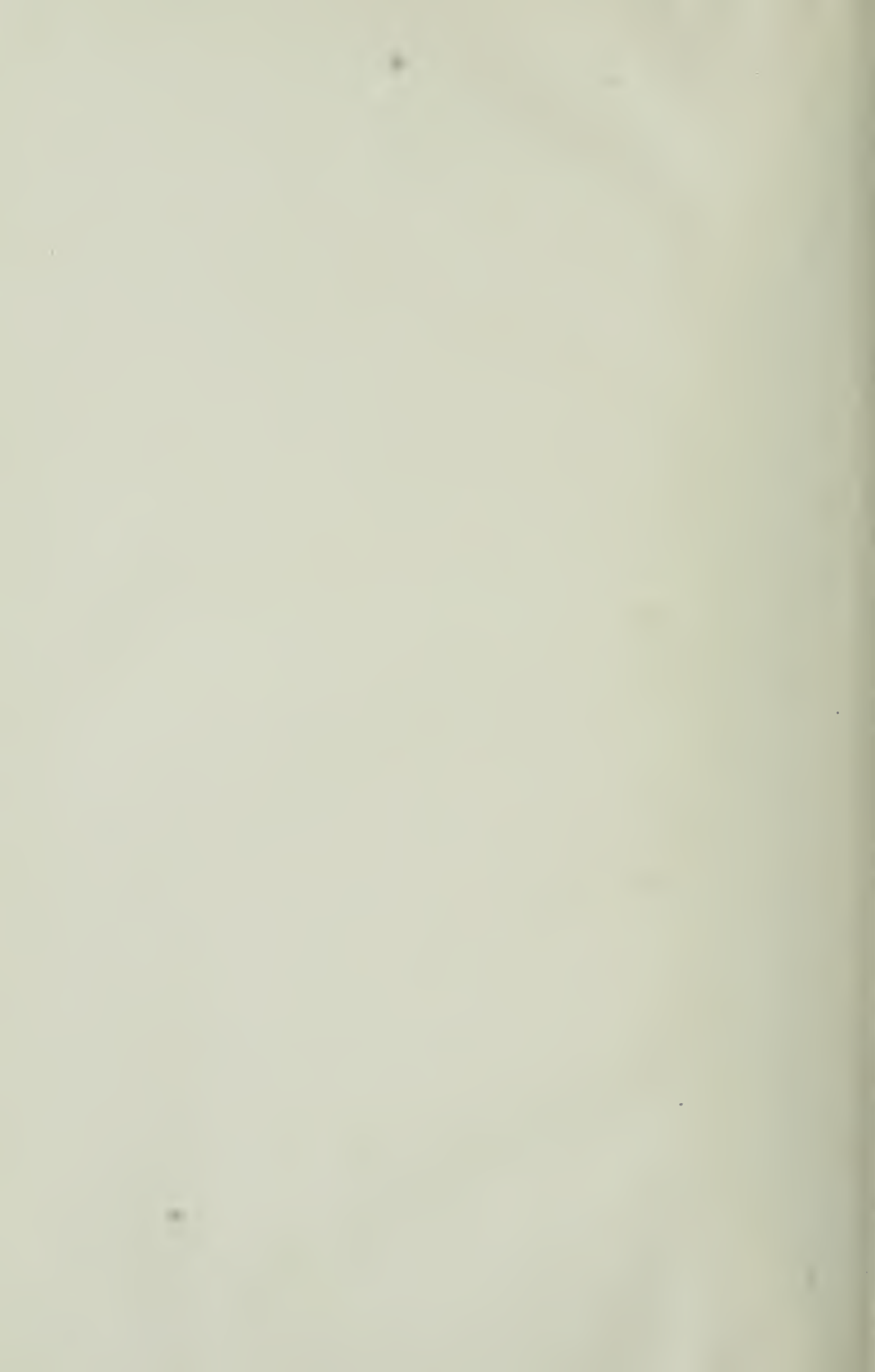
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